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No. 96

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CHINA REPORT

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APPLIED SCIENCES

EFFORTS TO LEARN MORE ABOUT DOLPHINS' ACOUSTICS SYSTEM

Nanjing NANJING GONGXUEYUAN XUEBAO [JOURNAL OF NANJING INSTITUTE OF TECHNOLOGY] in Chinese No 2, 1980 pp 121-126

[Article by the Research Team of Underwater Acoustic Bionics of the Radio Engineering Department: "The Biological Transmissive Window--Measurements of Acoustic Characteristics of the Melon* of the Lipotes Vexillifer"]**

[Text] Abstract

This article includes two parts.

The first part discusses the function of acoustic transmission of the melon in sound emission by the lipotex vexillifer from the point of view of bionics of biological sonar systems. Two suggestions have been proposed on the basis of the fundamental theory of total transmission in the design of the underwater sonic transducer diversion dome:

1) The density (ρ) of the melon can change; i.e., the wave impedance ($Z = \rho C$) can change to provide maximum transmission of energy when emitting different kinds of signals.

2) The shape of the melon can change; i.e., the curvature can change to adapt to the directional characteristics needed in locating, communicating, and hunting.

The second part is the preliminary report of the acoustic measurements of the melon of the lipotex vexillifer taken from 1 to 4 February 1980 in our institute's noise-absorption pool ($4x5x8m^3$).

*The melon is a fatty body in the head of dolphins with focusing and acoustic transmission functions in biological sonar systems.

**This article was received on 25 March 1980.

I. The Melon and the Diversion Dome

The sonar system of the dolphin is far superior to the sonar used by the navy today. There are two different schools of thought in international circles in explaining the question of the source of sound in dolphins. One school believes the air sac inside the head of the dolphin is the source of sound. Sound generated by vibration of the air sac is transmitted via the piece of fat called the melon in the front of the cranium. Another school believes the throat of the dolphin to be the source of sound. After it generates sound waves, the melon focuses the sound and transmits it. Regardless of which explanation [is correct], the melon performs an important function as the "biological transmissive window" in sound emission by dolphins.

On the outside of the actual sonar transducer is a dripping diversion dome used to reduce hydrodynamic noise (reduce turbulence) and to prevent marine life from clinging to the emitting surface or receiving surface of the transducer. When the diversion dome is designed, it must be acoustically transmissive. Transmission loss must be reduced to a minimum when emitting and receiving sound waves, and at the same time the directional map of the transducer must not be affected. Because transmission loss and the coefficient of reflection are proportional to the frequency of sound waves and the thickness and density of the dome, the diversion dome is generally made of thin, light material and is streamlined and curved. According to Urick of the United States, the thickness of the acoustic window of the diversion dome during World War II was 0.02 to 0.06 inches.

We believe that if the diversion dome of the transducer can be designed to possess the acoustic characteristics of the melon of dolphins, then a technological breakthrough will be realized in the transmission and reception of sound and signal processing.

II. Biological Transmissive Window

The lipotes vexillifer emits sound waves which are transmitted outwardly via the melon. From the point of view of minimal energy loss, we believe sound waves that pass through the melon are transmitted totally. In the following, the function of the biological transmissive window is explained by the fundamental principles of total transmission.

Figure 1 shows the reflection and refraction of the incident sound waves that occur on the boundary surface.

After eliminating the time factor e^{-jwt}, they can be represented by the velocity potential Φ:

$$\Phi_{incidence} = A \cdot e^{jk_1 (x \sin\theta_1 - z \cos\theta_1)} \quad (1)$$

$$\Phi_{reflection} = V \cdot A \cdot e^{jk_1 (x \sin\theta_1 + z \cos\theta_1)} \quad (2)$$

$$\Phi_{transmission} = W \cdot A \cdot e^{jk_2 (x \sin\theta_2 - z \cos\theta_2)} \quad (3)$$

where: A -- amplitude of the velocity potential of the incident wave
V -- coefficient of reflection
θ_1 -- angle of incidence
W -- coefficient of transmission
θ_2 -- angle of transmission
k_1 -- number of waves of the lower medium
k_2 -- number of waves of the upper medium

According to the continuation of sound pressure, the coefficient of reflection can be obtained from the vibration velocity of a particle in the normal direction through a continuous boundary condition:

$$V = \frac{m \cdot \cos\theta_1 - \sqrt{n^2 - \sin^2\theta_1}}{m \cdot \cos\theta_1 + \sqrt{n^2 - \sin^2\theta_1}} \tag{4}$$

where: $m = \rho_2/\rho_1$, $n = \frac{\sin\theta_1}{\sin\theta_2} = \frac{K_2}{K_1} = \frac{C_1}{C_2}$

When the coefficient of reflection (V) equals zero, all of the incident energy enters the second medium. This phenomenon is called total transmission.

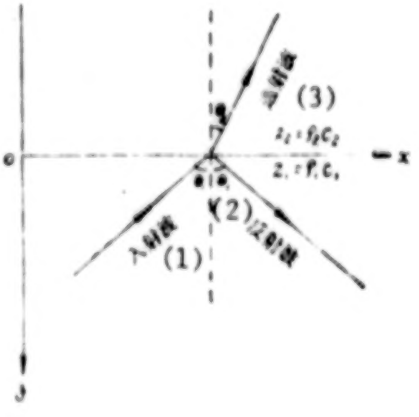

Figure 1. Reflection and Transmission of Sound on the Boundary Surface

Key: (1) Incident wave (2) Reflective wave (3) Transmissive wave

In the sound emission by the lipotes vexillifer, sound waves pass through the melon. Figure 2 shows a sound wave passing through a separation layer (melon) according to the simple situation described above.

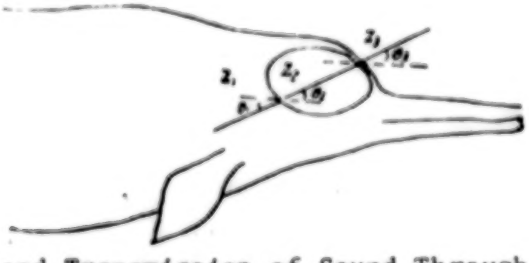

Figure 2. Reflection and Transmission of Sound Through the Melon

The coefficient of reflection (V) and the coefficient of transmission (W) obtained are as follows:

$$V = \frac{Z_2(Z_3 - Z_1) - j(Z_2^2 - Z_1Z_3)tg(K_2d\cos\theta_2)}{Z_2(Z_3 + Z_1) - j(Z_2^2 + Z_1Z_3)tg(K_2d\cos\theta_2)} \tag{5}$$

$$W = \frac{2Z_2Z_3}{Z_2(Z_3 + Z_1)\cos(K_2d\cos\theta_2) - j(Z_2^2 + Z_1Z_3)\sin(K_2d\cos\theta_2)} \tag{6}$$

It can be seen from the above formulas that maximum transmission (V = 0, W = 1) can be realized of the thickness (d) of the melon and the wave impedance of each layer of the media (Z_1, Z_2, Z_3) are appropriately matched; i.e., the impedances are matched. When the thickness of the melon is an integral multiple of half wavelength, the melon (half wave layer) will not cause a reflection of the incident perpendicular sound wave, just as if it were being shorted. This is because when the thickness of the melon is an integral multiple of half wavelength, we have:

$$d = n \cdot \frac{\lambda_2}{2} \qquad n = 1, 2, 3, \ldots\ldots\ldots$$

When the incidence is perpendicular, $\theta_2 = 0$, thus $\cos\theta_2 = 1$, we have

$$K_2d\cos\theta_2 = \frac{2\pi}{\lambda_2} \cdot n\frac{\lambda_2}{2} = n\pi$$

Substituting into equations (5), (6), we have:

$$V = \frac{Z_3 - Z_1}{Z_3 + Z_1} \tag{7}$$

$$V = \frac{2Z_3}{Z_3 + Z_1} \tag{8}$$

Thus it can be seen that the coefficient of reflection and the coefficient of transmission are unrelated to the wave impedance Z_2 of the melon. They are related only to the wave impedances of the first and third media. At this time, if $Z_1 = Z_3$, then V = 0, W = 1. When the diversion dome of the underwater acoustic transducer is designed, its thickness should be designed to be a half wavelength, and with the dome filled with sea water, i.e., $Z_3 = Z_1$, then the emission energy can be transmitted totally. When the thickness of the melon is an odd integral multiple of 1/4 wavelength, and even when $Z_1 \neq Z_3$, as long as $Z_2 = \sqrt{Z_1 \cdot Z_3}$, total transmission can be obtained in the same way. Based on this fundamental principle, our suggestions concerning the functions of the melon of the lipotes vexillifer are the following two points.

1) The dissected melon of the lipotes vexillifer looks like a melon sac filled with fat. When the lipotes vexillifer emits a sound signal, its density (ρ) can change; i.e., the wave impedance ($Z = \rho c$) can change. This is because the sonic pulse (click) of the lipotes vexillifer may have different frequency codes. To adapt to the emission of sound waves of different frequencies so that they may all be transmitted with maximum energy, the melon functions as a "biological transmissive window."

2) The lipotes vexillifer lives in our nation's Changjiang. The water of the river is turbid. In such an ecological environment, its vision is poor. Although it has retained its vitreous humor and optic nerve, they are both in a degenerated state. In such a state, they are thought to retain the function of sensing light, but it is difficult for the eye to serve as a sensory organ to observe external surroundings. Therefore, when the lipotes vexillifer swims at high speed, it must rely on wide-angle searching and narrow-angle locating of direction performed by its biological sonar system in order to avoid obstacles and look for food (fish), and it must rely on the variation in width of its directional wave bundles. Therefore, as it adapts to the different situations of hunting for food, locating, and communicating, we assume that the shape of the melon of the lipotes vexillifer can change to vary the direction of emission, and we also assume the curvature of the melon can change to vary the focus of the wave bundles.

The two points described above are based on the theory of design of the diversion dome and the viewpoint of maximum transmission of energy. The assumptions made about the ecology of the lipotes vexillifer in the Changjiang have their bases, but these are extremely deficient and there is no live experimental basis. The study of this topic in bionics awaits development by the close cooperation of people in biology, physiology, underwater acoustics, electronics, mathematics, and anatomy.

III. Parameters and Measurements

From 1 to 4 February 1980, preliminary acoustic measurements were made of the actual melon of the lipotes vexillifer in the sound-absorbing pool ($4x5x8m^3$) of the Department of Radio Engineering of our institute. On the one hand, such an acoustic measurement had not been conducted in our nation or in foreign nations before. Therefore we had no experience. On the other hand, the melon which we measured was not live but was only a segment; therefore the experimental data can be used only as reference and for comparison.

In designing the acoustic system of an actual sonar station, the selection of the materials for the acoustic transmissive window and the selection of the sealing and packaging compound for the basic array are both very important. Their density, sonic velocity, coefficients of reflection, and coefficients of sonic transmission must all be measured accurately in water. Therefore, we measured the density, input loss, and echo attenuation of the "biological transmissive window"--the melon of the lipotes vexillifer. The preliminary report follows:

1) Density of the melon (ρ)

At a room temperature of 15°C, the density of the melon of the lipotes vexillifer was $\rho = 0.866$ grams/cubic centimeter.

2) Input loss:

The melon was placed between the source of sound and the receiver. Without diffraction, the number of decibels that causes a drop in the level of the signal is the input loss, defined as:

$$IL = 20\log \frac{\text{incident sound pressure}}{\text{transmissive sound pressure}} \tag{9}$$

Obviously, the input loss of the melon of the lipotes vexillifer consists of the reflection of sound on the melon and the absorption of sound in the melon.

We used a piece of foam plastic 290x350mm^2 and made a small hole 15mm in diameter; then we placed a segment of the melon of the lipotes vexillifer firmly in the hole. The setup of the experiment is illustrated in Figure 3.

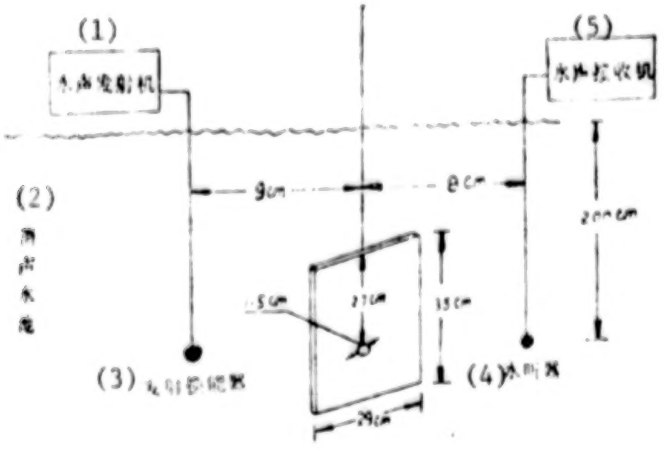

Figure 3. Illustrative Diagram of Measuring Input Loss

Key:

(1) Underwater sound transmitter
(2) Sound absorbing pool
(3) Transmission transducer
(4) Hydrophone
(5) Underwater sound receiver

When the melon was not in the hole, the output voltage of the hydrophone measured was Vo. When the melon was in the hole, the output voltage of the hydrophone measured was V_M. The recorded data are as follows:

f	Kc	90.0	101.8	121.0	141.0	160
V_o	mv	21.0	17.0	0.9	5.6	2.9
V_m	mv	10.5	14.0	1.4	4.4	3.2
IL		6.02	1.69		2.09	

It can be seen from the above experimental data that sound transmission is better when the melon of the lipotes vexillifer is at 101.8kc. But at 121kc and 160kc, Vm > Vo. In other words, the output of the hydrophone when the melon was in the hole was greater than when the melon was not present. This point could not be explained, except for our suspicion of experimental error. The sources of error in the measurement of the above experimental setup would be:

1) Reflection from the case of the transducer.
2) Diffraction occurring around the test sample.
3) Directional properties of the receiving and transmitting transducers.
4) Error in the position and error in the distance between the receiving and transmitting transducers.

3) Echo attenuation

Echo attenuation is a measure that describes the degree of reduction of the incident sound pressure after being reflected. It is determined by the degree of mismatch of the sound impedance of the material and the sound impedance of water, defined as:

$$EA = 20\log \frac{\text{incident sound pressure}}{\text{reflective sound pressure}} \tag{10}$$

Its theoretical formula is:

$$EA = 10\log \left[\frac{4m^2}{(1-m^2)^2 \sin^2 kd} + 1\right] \tag{11}$$

When $d = n \cdot \frac{\lambda}{2}$, $kd = \frac{2\pi}{\lambda} \cdot \frac{n\lambda}{2} = n\pi$, i.e., $\sin kd = 0$, $EA = \infty$, physically it means that when $d = n \cdot \frac{\lambda}{2}$, for any finite value of m (m is the ratio of the characteristic impedance of the melon and the characteristic impedance of water, $m = (\rho c)M/(\rho c)W$), the echo attenuation is always infinite--i.e., total transmission of sound. This is entirely consistent with the theory of designing the diversion dome of the transducer at half wavelength, as described previously.

Figure 4 shows the experiment diagram for measuring echo attenuation.

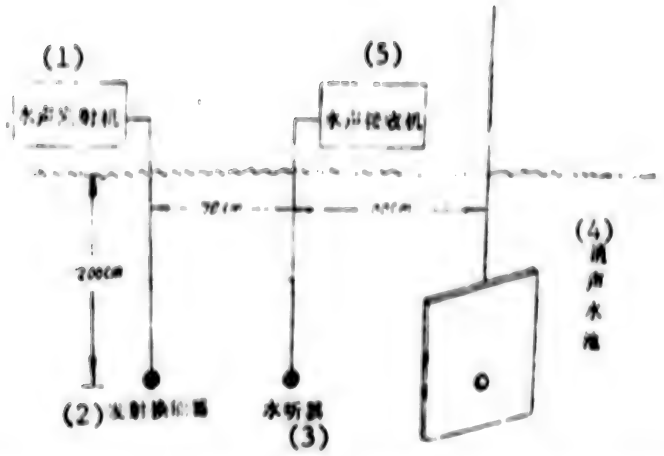

Figure 4. Diagram of the Experiment of Measuring Echo Attenuation

Key:
(1) Underwater sound transmitter
(2) Transmission transducer
(3) Hydrophone
(4) Sound-absorbing pool
(5) Underwater sound receiver

We used Vd to represent the output voltage of the hydrophone when receiving a direct wave, and Vr to represent the output voltage of the hydrophone when receiving a reflected wave from the melon. The recorded data are tabulated below:

f	kc	71.6	90.0	102.0	120.0	140	160
V_d	mv	13.3	18.8	13.0	4.2	2.4	1.3
V_r	mv	4.0	3.53	3.12	1.4	0.8	0.6
E.A.		10.44	14.53	12.4	9.54	9.54	6.72

We carried out the experiment to measure EA, but the error was large because the foam plastic also caused reflection. Thus, the results can be used only as reference for similar experiments.

In this experiment, there were two methods to differentiate incident sound from reflected sound:

1) Short pulse method: This method used the time difference of the short pulse traveling from the hydrophone to the melon and then being reflected from the melon to the hydrophone to separate the incident wave and the reflected wave.

2) Method of interference: Two signals were allowed to overlap and the greatest signal level and the smallest signal level were formed by interfering the phasing increases and interfering phasing decreases to calculate the incident wave and the reflected wave.

The ideal "transmissive window material" should have a transmission coefficient of 100 percent and a reflection coefficient of 0; i.e., the input loss is 0 and the echo attenuation is infinite.

In the above experiment, we neglected energy loss. In theoretical analysis, energy loss due to absoption must be considered. This requires the introduction of the complex dissemination coefficient ($\dot{K}$) and complex reflection and transmission coefficients ($\dot{V}$ and $\dot{W}$).

IV. Conclusion

1) The melon of the lipotes vexillifer (including the melon of the dolphin) is a topic of bionics of the underwater acoustic transmissive window. It is also a potential topic in improving the design of the sonar transducer and the diversion dome, as well as in increasing the efficiency of emission, the sensitivity of reception, the signal to noise ratio, and signal processing technology.

2) Based on the fundamental theory of acoustics and the ecology of the lipotes vexillifer in Changjiang, we propose the following two suggestions:

(a) The density of the melon of the lipotes vexillifer can change; i.e., the wave impedance can change to achieve maximum transmission of sound energy.

(b) The shape of the melon of the lipotes vexillifer can change; i.e., the curvature can change to vary the direction of the wave bundles and the focusing of sound.

3) The above experiment is extremely preliminary. Anatomically, the melon of the lipotes vexillifer tested was not whole, and it was not measured acoustically as a live object. Therefore, it is difficult quantitatively to explain the problem based on the experimental data obtained. The data are a reference for furthering the work.

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APPLIED SCIENCES

OBSERVATORY COORDINATES DETERMINED BY SATELLITE DOPPLER EFFECT

Beijing TIANWEN XUEBAO [ACTA ASTRONOMICA SINICA] in Chinese Vol 21 No 4 Dec 80 pp 399-403

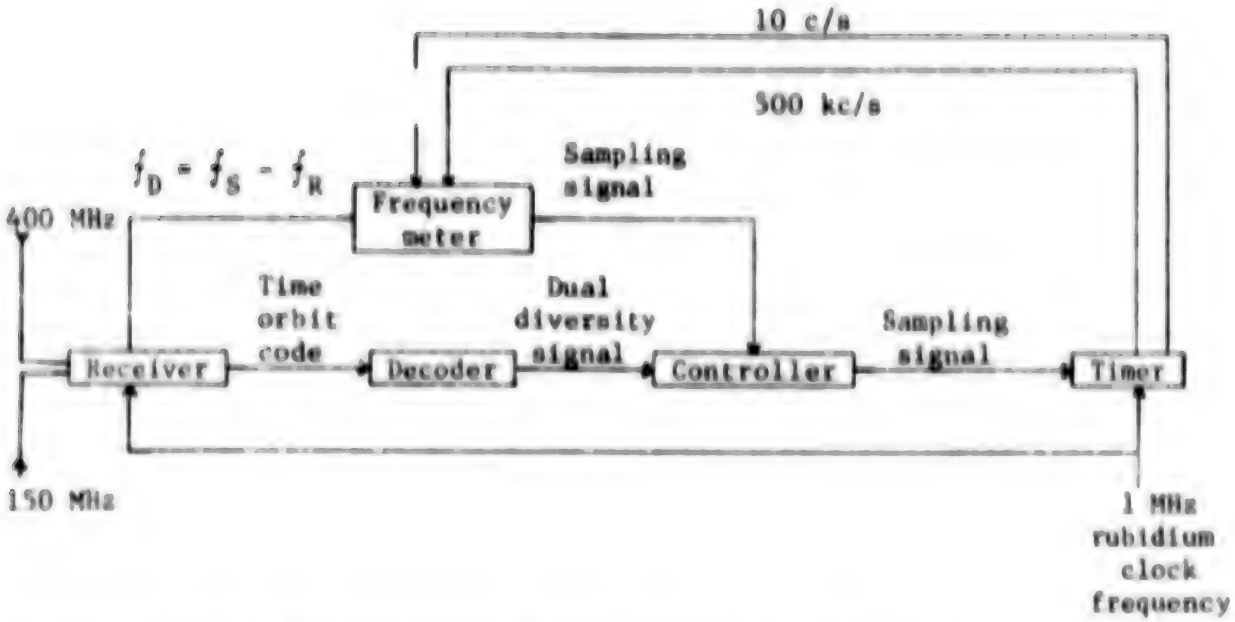
[Article by Zhu Wenyao [2612 2429 5069], Xu Huaguan [6079 5478 0385], Xu Suidi [1776 4840 6611], Zhu Guoliang [2612 0948 5328] and Chu Zongyuan [0328 1350 0337] of the Shanghai Observatory, Chinese Academy of Sciences: "The Determination of Geocentric Coordinates by Means of Satellite Doppler Method on a Single Station"; received 4 March 1980]

[Text] Abstract

Using the Chinese made two-frequency Doppler velocimeter JSZ-4 we determined the geocentric coordinates of our observatory. In this paper we present a method for calculating the coordinates through the observation of multiple passes in the single-station positioning. Using an indirect three-dimensional solution method, we obtained measurement results on the position of plane points with an internal consistency of 4m.

I. Satellite Clock Match and Observation Data Processing

Observations made in this work are based on the station clock time system. In order to make use of the broadcast ephemeris transmitted by the satellite, the satellite clock time must be converted to the station clock time; this conversion is realized by the satellite clock matching method. In this method the 1 MHz frequency of a rubidium clock is connected to the local timer and the clock is first synchronized with the timing marks broadcasted by the observatory station. When the satellite enters the detection range, the decoder begins searching for the dual diversity signal and all the recording apparatus are in their ready state. Since the decoder is capable of synchronous detection of the dual diversity signal in the time orbit code, the dual diversity signal can be used to sample the timer and to match the satellite clock. In the meantime the controller is actuated by the dual diversity signal and automatically enters the operational mode. A block diagram of the satellite clock matching circuit is shown below.



ΔT obtained from the comparison should consist of three parts:

$$\Delta T = \frac{\rho}{c} + \delta t_1 + \Delta t. \qquad (1)$$

where the first term on the right hand side is the transmission time of the satellite dual diversity signal, which can be determined accurately. δt_1 is the delay time of the receiver and the decoder, the delay time of the decoder is usually less than 50 μs; and Δt is the time difference between the readings of the satellite clock and the station clock. The values of measured $\delta t_1 + \Delta t$ are generally within 1000 μs.

Data processing consists of the generation of the broadcast ephemeris, the decoding, the correction of the Doppler count, and discarding the wild values. We obtained the broadcast ephemeris using a decoder that we built. Through a "majority judgment" procedure, a set of reliable fixed parameters and the 2-minute variable parameters of the pickup number group are obtained. These are used in the subsequent calculations of the satellite coordinates and velocity.

The errors in Doppler count mainly come from three sources:

(i) the measurement error in the receiver, approximately 0.023 Hz;
(ii) the refraction effect of the ionosphere; however, since the receiver deals with two harmonically related frequencies, the first order term of the ionosphere effect is eliminated and the residual effects are very small; (iii) the refraction in the troposphere. Based on the accuracy tolerance in the computation, we made appropriate simplifications to the usual Hopfield equation[1] for troposphere refraction correction:

$$\Delta\delta_T(t_i) = \sec^2 Z_i \sin Z_i \cdot \dot{Z}_i \left(A' \frac{P}{T} + B' \frac{e}{T^2}\right). \qquad (2)$$

in which Z_i is the apparent zenith distance of the satellite at time t_i, $\dot{Z}_i$ is the time rate of change of Z_i and can be obtained by a linear extrapolation of Z_i. P, T and e are the surface meteorological data at the time of observation: P is the atmospheric pressure, T = 273° + t°C is the atmospheric temperature and e is the water vapor pressure, given by the following equation:

$$e = \frac{4}{3} \text{ Hexp } (-37.2465 + 0.213166\ T - 0.000256908\ T^2) \text{ (mb)},$$

where H is the percentage relative humidity. The values of A' and B' are given by the following expressions:

$$A' = \frac{1}{3} \times 10^{-7} \times 77.6\ (r_{erol} - r_T) \left(\frac{r_{erol}}{r_T} + 5 \right),$$

$$B' = \frac{1}{3} \times 10^{-7} \times 77.6 \times 4810\ (r_{ero2} - r_T) \left(\frac{r_{ero2}}{r_T} + 5 \right),$$

in which $r_{erol} = (43.130 - 5.206 \sin \varphi_T) + r_o(\text{km})$ is the geocentric distance of the top of the dry troposphere, and $r_{ero2} = 12 + r_o(\text{km})$ is the geocentric distance of the wet troposphere. $r_o = r_T - h_T$, with r_T being the geocentric distance of the observation station and h_T the altitude of the station. φ_T is the latitude of the observation station. For the same observation station, A' and B' are constants.

We use the o-c method in discarding the wild points. Each datum point is calculated and tested for $|\dot{s}_o(t_i) - \dot{s}_c(t_i)| \geq \varepsilon$, the datum point discarded if the test result is positive. The value of ε is determined according to the accuracy of the apparatus, the approximate coordinates of the station and the accuracy of the broadcast ephemeris.

II. Three-Dimensional Indirect Solution in the Satellite Doppler Single Station Positioning

In this work we have carefully investigated the effects of height errors on the latitude and the longitude in two-dimensional positioning. We arrived at the following conclusions after extensive computations for multiple passes of a "meridian" satellite at different maximum elevation angle and direction of motion:

1. Errors in height affects mainly the longitude of the station and have little effects on the latitude.

2. The effect of the height error on the longitude depends on the relative position of the station with respect to the satellite orbit plane:

(i) When the station is to the east of the orbit plane, the height error ΔH and the longitude error ΔL have opposite sign. To the west of the orbit plane, ΔL and ΔH have the same sign.

(ii). The closer the station to the orbit plane (i.e., the larger the maximum elevation angle of the satellite), the greater the effect on the longitude. The functional relation between ΔH and ΔL is as follows[2]:

$$\Delta L = \lambda \tan h_{max} \cdot \Delta H. \tag{3}$$

in which h_{max} is the maximum elevation angle of the satellite and λ is a proportionality constant. For the same station and the same satellite, λ is approximately a constant when the receiver is stable.

The three conclusions described above form the basis for our three-dimensional indirect solution. In actual practice we select one or two passes of the satellite with relatively large h_{max} and perform two-dimensional solution for a series of heights with relatively large* increments (such as 5m) to obtain the corresponding longitudes and latitudes. Because the longitude is very sensitive to the error in height at this time, we can determine the approximate range (30-40m) of the station altitude from the known approximate value of the station longitude.

On this basis we then select passes with orbit planes of east-west symmetry with respect to the station and carry out two-dimensional solutions for a series of heights at a smaller increment (e.g., 2m) in the height range obtained above. (In order to reduce the errors of the satellite ephemeris along the orbit direction, the symmetry of the ascending section and the descending section should also be considered.) For each height value, the corresponding average values of the longitude and the latitude $(\bar{L},\bar{B})$ and their mean errors (m_L,m_B) are found. Since the satellite passages chosen are east-west symmetric, it is obvious that the larger the error in height, the greater the mean error m_L in longitude. The minimum of m_L corresponds to the correct geodetic height. From the series of longitude mean errors obtained above, one can select the optimum values of the three-dimensional coordinates of the station as being the geodetic height, the longitude and the latitude corresponding to the minimum m_L.

The mathematical model of the two-dimensional positioning using the JSZ-4 Doppler receiver is as follows:

$$\Delta\dot{\delta}_i = \dot{\delta}_{io} - \dot{\delta}_{ic} = \frac{\partial\dot{\delta}_{ic}}{\partial L}\Delta L + \frac{\partial\dot{\delta}_{ic}}{\partial B}\Delta B - \frac{\partial\dot{\delta}_{ic}}{\partial f_{Ks}}\Delta f_{Ks} + v_i \tag{4}$$

* Large errors in height may lead to nonconvergent two-dimensional solutions.

in which

$$\frac{\partial \rho_{iw}}{\partial L} = \left(\frac{\partial \rho_{iw}}{\partial X}, \frac{\partial \rho_{iw}}{\partial Y}, \frac{\partial \rho_{iw}}{\partial Z}\right) \begin{pmatrix} -Y \\ X \\ 0 \end{pmatrix},$$

$$\frac{\partial \rho_{iw}}{\partial B} = \left(\frac{\partial \rho_{iw}}{\partial X}, \frac{\partial \rho_{iw}}{\partial Y}, \frac{\partial \rho_{iw}}{\partial Z}\right) \begin{pmatrix} -X \tan B \\ -Y \tan B \\ Z \operatorname{ctg} B \end{pmatrix},$$

$$\frac{\partial \rho_{iw}}{\partial f_{Ks}} = -\frac{t}{f_s},$$

$$\frac{\partial \rho_{iw}}{\partial X} = -\frac{1}{\rho_i}\left[x_s - \frac{\dot{x}_s}{\dot{\rho}_s}(\rho_i - X)\right],$$

$$\frac{\partial \rho_{iw}}{\partial Y} = -\frac{1}{\rho_i}\left[y_s - \frac{\dot{y}_s}{\dot{\rho}_s}(\rho_i - Y)\right],$$

$$\frac{\partial \rho_{iw}}{\partial Z} = -\frac{1}{\rho_i}\left[z_s - \frac{\dot{z}_s}{\dot{\rho}_s}(\rho_i - Z)\right].$$

where $\dot{\rho}_{io}$ and $\dot{\rho}_{ic}$ are respectively the observed and calculated sight line velocities of the satellite at time t_i. The observed velocity is given by:

$$\dot{\rho}_{io} = \frac{c}{f_s}\left(\frac{N_i}{\Delta\tau} - f_{Ks}\right) + \Delta\dot{\rho}_T(t_i). \tag{5}$$

where $\Delta\tau$ is the time interval of the count and N_i is the ith Doppler count. The calculated velocity is given by:

$$\dot{\rho}_{ic} = \frac{1}{\rho_i}\left[\dot{x}_i(x_i - X) + \dot{y}_i(y_i - Y) + \dot{z}_i(z_i - Z)\right]. \tag{6}$$

where ρ_i is the distance between the satellite and the station at time t_i, given by the following expression:

$$\rho_i = \left[(x_i - X)^2 + (y_i - Y)^2 + (z_i - Z)^2\right]^{1/2}. \tag{7}$$

In the above equations X, Y, and Z are the cartesian coordinates of the station in the earth-bound coordinate system, L and B are the geodetic longitude and latitude of the station, ΔL and ΔB are the corrections to L and B, Δf_{Ks} is the frequency drift to be evaluated and v_i is the residual difference.

The coordinates (x_i, y_i, z_i) and the velocities $(\dot{x}_i, \dot{y}_i, \dot{z}_i)$ of the satellite in the earth coordinate system at time t_i can be obtained from fitting the variable parameters of the broadcast ephemeris to the fixed parameters. In this work we first find the satellite coordinates at even-number minutes from the fixed parameters and the variable parameters at even-number minutes. We then use the 7th order Chebyshev interpolation polynomial to find the coordinates and velocities of the satellite at the datum point time by interpolation.[3] The equation is

$$\mathbf{r}_i = \sum_{k=0}^{7} \mathbf{B}_k \, T_k \, (\tau). \qquad (8)$$

where T_k (τ) is Chebyshev polynomials of the first kind and τ is an interpolation constant defined in the close interval $[-1,1]$. Here we can take τ to be $2(t_i - t_o)/\Delta T - 1$ where t_o is the initial time of the variable parameters at even-number minutes of the decoded pickup number group, and ΔT is the total time interval of the pickup number group. $\mathbf{B}_k = (B_{xk}, B_{yk}, B_{zk})$ are the coefficients of the interpolation formula and can be arrived at with a least square method using the known values of the satellite coordinates at even-number minutes. Thus, Eq. (8) can be used in finding the satellite coordinates $\mathbf{r}_i = (x_i, y_i, z_i)$ for any time.

The corresponding velocity of the satellite at time t_i is

$$\dot{\mathbf{r}}_i = \frac{2}{\Delta T} \sum_{k=1}^{7} \mathbf{B}_k \, \dot{T}_k \, (\tau).$$

where $\dot{T}_k(\tau)$ is obtained by differentiating $T_k(\tau)$ with respect to τ.

III. Preliminary Results and Analysis of the Observations

We averaged the data of 52 satellite passes selected from the observations of 150 satellite passes. Our selection criteria are as follows:

1. only satellite passes with east-west symmetry of the orbit plane and ascending-descending symmetry are selected.

2. satellite passes with maximum elevation angles less than 15° are discarded.

3. satellite passes with maximum elevation angles greater than 80° are discarded.

4. single passes with large errors are discarded.

5. passes with gross asymmetry of the highest point with respect to the data points are discarded.

For the 52 qualified passes, data points with elevation angles greater than 75° and less than 15° are also discarded. Each datum point is then weighted by 1 for $30° \leqslant h \leqslant 65°$ and by 0.8 for the rest of the data. The average results of the 52 passes are:

$$H = 118\text{m}, \; L = 121°11'19.''59, \; B = 31°05'47.''07.$$

and the internal accuracy of the plane points is ±4m.

The three-dimensional observation results on 38 passes using an imported MX-1502 receiver are:

$$H = 126m \quad \lambda = 121°11'19\overset{s}{.}25, \quad B = 31°05'46\overset{s}{.}81.$$

Analysis and discussion of the results:

1. In the single station positioning with a JSZ-4 Doppler receiver, the satellite velocity must be calculated using the broadcast ephemeris. Since the parameters of the satellite ephemeris are obtained by a least square fit with a set of known cartesian coordinates of the satellite in the earth coordinate system, the three variable parameters only represent the corrections to the space coordinates of the satellite and not the corrections to the velocities of the satellite. Hence this method does not give accurate values for the velocities. We used several schemes in fitting the satellite coordinates and velocities with the broadcast ephemeris; the results indicate that the satellite coordinates fitted with various schemes differ very little and the velocities obtained are generally not satisfactory. This is a drawback of the single station positioning using a JSZ-4 receiver.

2. In our calculation we made the error by using the equatorial radius of the earth a = 6378140m but the radius is actually a = 6378135m in the WGS-72/NWL-10F geodetic system to which the broadcast ephemeris of the "meridian" satellite belongs. This could be the reason for our low computed values of the geodetic height.

3. In our measurements we used $0\overset{s}{.}4$ as the sampling interval. Based on our analysis and discussion, the errors would have been smaller if a sampling interval of 1^s were used.

All members of the Doppler problem group at the Shanghai Observatory have participated in the work of observation and data processing.

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USEFUL EXPERIENCES IN TREATMENT OF WAR WOUNDED

Beijing JIEFANGJUN YIXUE ZAZHI [LIBERATION ARMY MEDICAL JOURNAL] in Chinese Vol 5 No 2, April 1980 pp 89-93

[Article by Lu Yupu [7120 5940 2613], Wei Zheng [7614 1767], Chen Shouqian [7115 0644 6197], Xu Shaoding [5171 1421 3060], Li Yunlian [2621 6663 6647], Huang Yaotian [7806 5069 3240], Wang Xilian [3769 6932 6647], Zhu Shengxiu [2612 4141 0208], Yao Jiang [1202 3068], and Huang Changlin [7806 2490 2651]: "Experience in Treating Those Wounded in Battle: A Discussion of Some Problems in the Treatment of Injuries to the Limbs and Vertebra Inflicted by Firearms"]

[Text] This article focuses on the discussion of the followup treatment of injuries to the limbs and vertebrae inflicted by firearms in the war of self-defense and retaliation against Vietnam.

I. General Statistics

The statistics of the various battles showed that the number of men with injuries to the limbs constituted about 60 percent of the total number of men wounded. Last spring, the statistics of different regions in the war of self-defense and retaliation were 63.5 percent, 47.7 percent and 51.7 percent. According to partial statistics, the percentage of wounds inflicted by shell fragments was 53.6 percent, the percentage of wounds inflicted by bullets was 40.9 percent, and the percentage of wounds otherwise inflicted was 5.8 percent. Statistics of one group of wounded men showed the number of men suffering from fractures of the limbs inflicted by firearms constituted 29.5 percent of the number of men with wounded limbs. The number of wounds of the large joints constituted 9.1 percent, the number of fractures of the lower limbs was 55.7 percent, and the number of fractures of the upper limbs was 44.3 percent. At different places, the percentage of death from wounds was from 0.43 percent to 0.9 percent. At many hospitals in the rear, there were no deaths resulting from the treatment of wounds of the four limbs. The causes of death were almost all due to syndromes, mostly bleeding or shock due to poisoning or acute kidney failure. A few died of heart failure or termination of breathing, gas gangrene, fascial interstice syndrome, fat embolism, and pulmonary arterial embolism. The percentage of amputations of wounded limbs in one group was 5.3 percent.

II. Treatment of Fractures of the Limbs Inflicted by Firearms

In the treatment of the wounded, treatment of fractures of the limbs inflicted by firearms was better, and therefore the percentage of occurrence of osteomyelitis was

low and fast healing of fractures and better recovery of functions were realized. The percentage of occurrence of osteomyelitis was about 4 percent. Most fractures healed within 3 months. The main experience was as follows:

1. Thoroughly cleaning the wound in time and early elimination of the wound and the use of sulphanilamide and antibiotics were the basic measures to close the open fracture and prevent osteomyelitis. They were also important conditions for smooth healing of fractures and for prevention of bone dislocation.

2. Reduction of broken bones: The first frontline hospital should use plaster to fix the position of the broken bones, after cleaning the wound inflicted by firearms. After the patient arrives at the second frontline hospital or the rear hospital, the broken bones should be manually treated by reduction, traction, and localization with plaster. Results of this method were good. Localization using small splints is not suitable for fractures caused by firearms.

With regard to the question of treatment of the wound and internal localization of the fracture, it has been proven by experience in first aid in many battles that after the wound caused by firearms is cleaned, the wound is not sutured and internal localization of the fracture is not performed. Through this practice, it has again been proven that this traditional principle is correct. In hospitals in the rear, operations to shift the position of the fracture and join or dislocate deformities should be performed under the control of antibiotics after the wound has healed, after the infection has been cured, and after the tissue has softened. In the operation, separation of the periosteum should be avoided as much as possible. Localization should be performed, using screws or inner marrow pins. Steel splints should be used less in localization.

The treatment of fractures of long diaphysis using external pins and steel splints for external localization was done on a group of wounded men in 55 cases. Of these, 50 recovered and complications did not occur. But in treating fractures of the diaphysis of the thighbone, because of the fullness of the muscles it was difficult to position the pin accurately. Thus there was a possibility of damage to the nerves and blood vessels, and it was also difficult to maintain the proper position of the fractured bones. If the pins were exposed, it was also easy for infections to occur. Therefore this method was not suitable. Use of this method to treat fractures of the shin and fibula is still being observed and studied, and it should not be popularized at present.

3. Problems Encountered at Present:

1) For some wounded men, the wound was not thoroughly cleaned. For a few, the wounds were mistakenly sutured immediately, bones were transplanted immediately and internally and metallically localized. Wounds became infected, osteomyelitis occurred, and even amputation was required as a result of gas gangrene or death from septicemia.

2) When cleaning the wounds of some wounded men, too many loose pieces of bone were removed, causing a lack of or damage to bones.

3) Problems of first aid, transportation, and localization: The supply of uniform splints was insufficient. The quality of some of the plaster was poor. Forming

was slow, and in treating some fractures of the hands and feet, the bones were not fixed at the functioning positions, forming crooked metatarsal bones, stiffening of the joints of the fingers, and inward twisting of the thumb. The joint of the wrist and the palm was not in a functioning position, seriously affecting the functions of walking and of the hands.

III. Injuries to Vertebrae and the Spinal Cord by Firearms

Injuries to the vertebrae and spinal cord by firearms are very dangerous. In the past, recovery was thought to be hopeless and the future was bleak. During the early period of the Second World War, death among American soldiers due to these types of injuries reached 47 to 80 percent. During the latter part of the war, antibiotics were used and measures to resist shock were improved. The death rate dropped to below 15 percent. The cause of death was multiple wounds, complications such as bedsores, infection of the urinary system and meningitis, epidural inflammation, and osteomyelitis.

In a group of 20 wounded men, there were 4 cases of injuries to the cervical vertebrae, 10 cases of injuries to the thoracic vertebrae, 5 cases of injuries to the lumbar vertebrae, one case of injury to the sacral vertebra. There were 14 cases of complete paraplegia and 6 cases of incomplete paraplegia. The conditions were serious, and most suffered from infection of the urinary system, bedsores (the largest was 20x20 cm), and fever. Seven were in critical condition.

Results of treatment: All of the patients recovered and regained normal health. Infection of the urinary system and bedsores were cured. There were no deaths. Seven of the cases recovered well and could urinate and defecate by themselves and could walk on the ground. Two cases showed improvement. In 11 cases, the nerves did not recover but the general health was good.

Major experience:

1. The frontline had treated wounds and combined wounds of the chest and stomach well and early. There was only one case where shell fragments remained inside the vertebral canal and infection was serious. Except for the critically wounded, all others should be rapidly sent to rear hospitals; an overly long transfer time should be avoided. Nursing on the way to the rear should be intensified to prevent bedsores and infection of the urinary system.

2. The wounded men should be centralized, and paraplegia wards should be set up. The clinical and nursing staff should be strengthened. Improvement of the health of the entire body should be grasped well. Complications, infection of the urinary system, and bedsores should be treated. Treatment of infection of the urinary system involves strict aseptic catheterization. The urinary catheter should remain in place for catheterization every 4 hours. The bladder should be washed once or twice a day with physiological saline. The urinary catheter should be changed once every week. The patient should drink a lot of water and eat a lot of fruit to maintain over 1,000 ml of urine. Efforts should be made to revive the nerves, to induce the patient to urinate and defecate by himself, or to train the patient in urinary reflex. When the remaining amount of urine is below 100 ml, the urinary catheter can be removed.

Treatment of bedsores: The method and the time of turning the patient over should be strictly regulated. The balloon must be well placed as a cushion so that the

bedsores are not pressured. The patient should be turned over once every 2 to 3 hours, depending on the seriousness of the condition. Patients with large bedsores should be placed in turning beds. The patient should sleep on his stomach more. The dead tissue of the bedsore should be cut away. Antibiotics should be applied in wet form (such as bacillus phthalein). When the newly grown flesh of the wound is fresh, skin should be grafted. The surface of the wound should be eliminated as early as possible.

3. The characteristics of injuries to the vertebrae and the spinal cord by firearms should be noted: (1) If the vertebrae are stable, and if traction or reduction is not needed, then the situation is beneficial for turning the patient over and the patient can get out of bed and be active sooner. (2) If the wound is infected, early operation does not require opening of the dura.

4. Efforts toward reviving the nerves: Excision of the intervertebral disk to alleviate pressure should generally be performed at the rear hospital. Those having symptoms should be subjected to operation earlier by creating conditions. For example, partial paraplegia, sunken intervertebral disks that produce pressure, shell fragments inside the vertebral canal, and injuries below the plane of the waist should all be operated on early. Operation is prohibited in the following cases: critical condition throughout the entire body; serious local infection or known penetration of the spinal cord; and broken spinal cord.

Key points of the operation: Under partial anesthesia, the upper and lower three intervertebral disks are excised. Broken pieces of bone, shell fragments, or sunken intervertebral disks are removed to reduce the pressure on the coccyx without opening up the dura. For patients paralyzed on one side, half of the intervertebral disk in a small area can be excised to reduce pressure.

5. Treatment of deep infection due to shell fragments in the vertebral canal: Under local anesthesia, one side of the intervertebral disk is exposed to remove the shell fragments that are blocking the canal. Swelling of granulations is treated by applying a wet solution of bacillus phthalein; after 1 week, the wound can be sutured.

IV. Injuries Inflicted by Firearms to Blood Vessels of Limbs

According to partial statistics, the number of injuries of blood vessels of the limbs constituted 1.63 percent of the number of injuries to the limbs. In one group of wounded men, the percentage of amputations was 18.8 percent. In another group of 30 cases, the percentage of amputations resulting from injuries to blood vessels inflicted by firearms was 10 percent. There were no deaths. In the rear hospitals, 41 cases of false aneurysm and arteriovenous fistula were treated. All were treated successfully. There were no deaths, and no amputations were required.

Treatment: Injuries to the large vessels of the limbs should be repaired mainly during the early stage. But because of the war environment, many wounded men came in within a short period of time, and transfusion was difficult. Repair of the arteries was limited to the major arteries, such as the large vessels above the arteriae poplitea and above the arteriae brachialis. If secondary blood vessels such as the two arteries of the shank or the forearms (the anterior and posterior arteriae tibialis or the arteriae ulnaris and arteriae radialis) are all injured and circulation is hampered, one artery can be repaired first. In treating injuries to the blood

vessels inflicted by firearms, cleansing of the wound should include cleaning the blood vessels themselves. The damaged part of the blood vessels that is visible to the naked eye should be excised up to 0.5 to 1 cm from the normal parts, and these parts of the vessels should be joined by anastomosis. If the injury is serious, the great saphenous vein on the near side of the healthy part of the body can be transplanted. Wounds to arteries inflicted by firearms should not be sutured on the sides, so as to prevent embolism. Wounds of veins can generally be ligated, but the venae femoralis and the venae poplitea should be repaired. When treating aneurysm or arteriovenous fistula formed by injuries to blood vessels of the limbs, it is not necessary to wait 3 to 6 months. As long as the wound has healed, the infection is under control, the inflammation has subsided, and the condition of the local tissue is good, surgery can be carried out 1 to 3 months. In treating injuries to blood vessels complicated by fracture, external localization should be done or small weights should be used in traction of the thigh bone. Apposition should be maintained. One must pay attention to the place of anastomosis to make sure the tissue is not too tight. Steel splints should not be used for localization. The percentage of amputations resulting from injuries to blood vessels is related to the time of treatment. In time of war, technical forces should be extended to the frontlines as much as possible. If conditions are difficult, the wounds should be cleaned and the end of the blood vessels should be ligated, bleeding should be stopped, and the patient should be immediately sent to the rear so that the blood vessels can be reapired at the second line.

Recurrent bleeding: This occurs mostly 5 to 14 days after injury. Bleeding should be stopped surgically as quickly as possible. When necessary, blood vessels should be repaired; this should not be delayed. Prevention should be established. Cleansing of the wound should be done well. Infection should be prevented. Injuries to the blood vessels should be examined and treated, and none should be missed. The movement of injured limbs should be controlled. Patients with injuries to the arteries that have formed haematoma which would become false aneurysm should lie in bed to rest and prepare for surgery.

V. Syndrome of Fascial Interstice as a Complication of Injuries to the Limbs Inflicted by Firearms

There are many reasons for the rise in interstitial pressure in tissues, and frequently they are syndromes. Overly tight bandaging of the limbs, and especially the use of tourniquet for a long time, can also cause this illness. If the tourniquet is too loose and the blood in the veins cannot flow back, the fascial interstice will enlarge. Swelling, fracture, injury to blood vessels, and serious infections caused by the increase in permeability of the capillaries of wounds and inflammation can all cause the pressure in the fascial interstice to rise, causing fascial interstice syndrome. This disease occurs mostly in the shank, followed by the forearm.

Symptoms and body illness: Statistics of a group of 54 patients showed that the limbs were extremely swollen, the muscles were tense and stiff, the patients suffered pain, and they had no strength for any activity. In 24 cases, the pulse at the far ends of the limbs were weak or could not be felt. In 14 cases the results of traction tests of groups of muscles were positive. There were nine cases that had pale skin and suffered from chills. There were six cases that suffered from dulling of the senses at nerve centers. There were five cases of blisters, two cases of rising skin temperature, four cases of ecchymosis, and five cases of contracture and deformation.

Method of Treatment and Results: Early operation to alleviate pressure is the only effective method. If pressure cannot be thoroughly alleviated in time, in less serious conditions contracture due to lack of blood will occur, and in serious conditions the limbs will deteriorate and die, and life will even be threatened. Of 160 cases, incision to alleviate pressure was performed in 114 cases. There were 60 cases that were cured because the pressure was thoroughly alleviated during the early period. Disabilities of different degrees all resulted from less thorough alleviation of pressure or from delays of over 24 hours. There were 6 cases of contracture due to lack of blood, 27 cases in which the patients lost partial functions of the limbs, and 21 cases that required amputation. Of the last 21 cases, 3 died of shock from poisoning and acute kidney failure after amputation. There were 46 cases treated without surgery. Seven recovered and 39 were amputated. Thus it can be seen that the syndrome of fascial interstice is an important cause of disability and death among wounded men with injuries to the limbs.

The requirement for incision of the fascia to alleviate pressure is to make a lengthwise incision to open the skin and the fascia timely and thoroughly in order to fully relieve the pressure in the interstice. Only in this way can the goal of the operation be achieved. Generally incisions are made on the shank on the front outer side and the back inner side to open up the skin, and via the two incisions of the skin described above, the pressure in the interstice of the four fasciae of the shank can be relieved.

II. Injuries to the Peripheral Nerves, and Burning Neuralgia

1. Injury to the peripheral nerves caused by firearms

According to partial data and statistics, injuries to the peripheral nerves constituted 8.3 percent of the injuries of the limbs. The ratio of injuries to nerves of the upper and lower limbs was [illegible]

Better results of treatment of adhesion of nerves surrounded by pressure from scars can be achieved for the most part by using neurolysis. For broken nerves, the results of suturing the broken ends are best. For the few cases where damage is severe, transplanting of free nerves or nerve loops can be used to repair the damage. This method produces a better result in treating small nerves and sensory nerves, but poorer results in treating large nerves and mixed nerves. Whether neurolysis or suture is used to repair nerves, care and accuracy must all be exercised to prevent worsening the damage to the nerves and a loss of the opportunity for recovery.

Microsurgery should be used to treat nerve injuries so that the operation proceeds from the macroscopic to the microscopic. The techniques of suturing the perineurium and groups of nerve bundles and transplanting nerve bundles were performed. The view was clear; this helped accurate repair, and the effect of the treatment was improved. But indications and techniques must be grasped correctly.

2) Diagnosis of Injuries to the Nerves

This depends mainly upon clinical examination. Electromyography and electrodiagnosis can be used for auxiliary examination.

In cleaning the wounds, care must be taken not to excise the injured nerve or to search for nerves or free the nerves. One must not use black string to tie the

broken ends to the soft tissue to prevent retraction. Freeing exposed nerves in an unsterilized environment will worsen the damage to the nerves and affect second treatment and repair. When searching for the broken ends of nerves during surgery in the second round of treatment, the search should usually begin by looking for the ends on the far side and the near side of the location of the normal nerves. Then it will not be difficult to find the broken ends.

2) Time and method of treatment

Creating conditions and early treatment of injuries to nerves are not limited by the concept of "treatment 3 to 6 months after the wound has healed." Surgery can be carried out under the following conditions: (1) the wound has already healed; (2) the skin and soft tissue are relatively healthy and soft; (3) mobility near the joints is better to facilitate bending of the joints so that the nerves can be shortened and suture can be performed.

Most of the wounded men with nerve injuries were for the most part performed 2 months to 2 months after the wounds had healed.

Neurolysis: First, careful external neurolysis was performed. Internal neurolysis was performed only when necessary. Among one group, neurolysis was performed on 57 nerves, and 52 showed visible recovery. There were also some wounded men whose symptoms worsened after their nerve bundle interstices were widely relaxed. They even felt that some had completely lost their motion. Therefore, attention must be paid to the indications and surgical techniques.

Neurosuture: The best results were obtained from end-to-end suture of broken nerves. This has also been an effective method in the past. The goal of realizing end-to-end suture when there is severe damage can be realized mostly by freeing the nerves, by bending the joints, and, when possible, by rerouting the nerve. When necessary, the nerves can be sutured temporarily or the broken end of the bone or the diaphysis can be shortened to realize end-to-end suture. In a group with 43 broken nerves, all except for 8 nerves were sutured end-to-end. Temporarily bending the joint will not affect the mobility of the joint later.

Some people have stated that when the injury to the nerves inflicted by firearms cannot be repaired by the methods described above, the method of repairing the nerves by transplanting free nerve bundles in interstices is proposed. It was believed that the effect of treatment would be improved. The surgical method is to transplant and suture the median nerve, ulnar nerve, radial nerve, and even the ischiatic nerve, which are vastly different in size from the fine and small cutaneous nerves and are limited in number. This method necessitates that a fair portion of the motor and sensory bundles cannot be sutured. Also, there is at present no effective method to determine and differentiate the sensory and motor nerve bundles at the proximal ends of the nerves. The growth of the neurite of nerves must pass through the neurilemma sheaths, and the results will be affected. If they are connected incorrectly, the nerves will not function. Transplantation of free nerves in interstices of nerve bundles was performed for 175 nerves (83.7 percent) out of 209 broken nerves in one group of wounded men. Transplantation was the major method used. At present, reports on the effect of the treatment have not yet been received; follow-up visits and summarization of the experience should be conscientiously carried out.

2. Burning Neuralgia

Burning neuralgia is rarely seen in peacetime but moreso during war. The reason is still not completely understood. It is generally believed that the stimuli of the sympathetic nerve go through a "shortcut" and are transmitted into the sensory fiber, causing excitation of the pain-sensing fiber, which in turn causes a burning pain and a relaxation-contraction reaction of the blood vessels. Reports on the wounded in battle abroad showed the percentage of occurrence constituted 1 percent to 3 percent of injuries to nerves. It reached 12 percent in some reports.

According to partial data and statistics, among the wounded men suffering from nerve injuries, from 10.1 percent to 12.5 percent suffered from varying degrees of burning neuralgia. Most suffered from injuries of the median nerve and the ischiatic nerve.

The treatment of burning neuralgia mainly involved neurolysis, and satisfactory results were obtained. It could eliminate or alleviate burning neuralgia and could also improve the sensory and motor functions. Neurolysis was performed in 48 cases, and the results of treatment were satisfactory. In less severe cases, if the nervous function is good, nonsurgical methods of treatment should be given more consideration to avoid damaging the nerves again during surgery. Nonsurgical methods of treatment were performed in 31 cases of burning neuralgia--intravenous injection of reserpine--and progress and visible results of treatment were realized.

VII. Gas Gangrene

Partial data and statistics showed the percentage of occurrence of gas gangrene to be from 0.24 to 0.5 percent. The percentage of occurrence of gas gangrene and a slightly higher percentage of amputation of the limbs were related to improper cleaning of the wounds and use of a tourniquet. More attention should be paid to these practices. The bandages should be cut open timely and fully for drainage, the tissues that have undergone pathological changes should be cleaned and removed, and hydrogen peroxide should be applied and injected. When the conditions are good, high-pressure oxygen can be used. The use of appropriate antibiotics is the key to reducing the occurrence of death and the percentage of amputations.

VIII. Amputation of Limbs Resulting From Injuries by Firearms

According to the analysis of a group of cases of amputations of limbs of wounded men, the causes for amputation were the results of: (1) damage due to external injury, constituting 51 percent; (2) injury of the large blood vessels, causing the limbs to deteriorate and die, constituting 16 percent; (3) gas gangrene, constituting 15 percent; (4) improper use of tourniquet, constituting 9 percent; (5) deterioration and death of tissue caused by the syndrome of fascial interstice, constituting 4.3 percent; and (6) serious infection, constituting 4.7 percent. There were 14 cases in which the patient underwent amputation but died as a result of serious gas gangrene or acute kidney failure.

Timely and conscientiously treating injuries to large blood vessels, correctly using the tourniquet, and conscientiously preventing gas gangrene, inflammation and infection, and fascial interstice syndrome are important in reducing the percentage of amputations.

The method of amputation of the wounded in battle: The method of open amputation should be used to realize full drainage. This can retain greater length and is safe. Traction of the skin should be continued after open amputation. Traction by socks is more appropriate than threads or adhesive bandages. From traction and redressing to healing of the wound generally requires about 5 to 6 weeks. The defective end should be repaired, and the patient should be fitted with artificial limbs. Using closed amputation to treat the wounded in battle is a mistake. Most of the wounds will be infected, and it will even cause the death of the wounded men. Some "semi-open amputations" were performed, but these were actually semiclosed methods which were conducive to the occurrence of infections and unfavorable to retaining the length of the limbs; this method should not be popularized.

IX. Rehabilitation of the Functions of Limbs During Latter Treatment of Injuries Inflicted by Firearms

In the latter treatment of the wounded with injuries to the limbs, there were nine cases involving the use of multiple tissue graft of skin with the tips of blood vessels taken from the upper part of the foot to repair the skin of a nearby position damaged by firearms, missing skin and damaged calcaneal tendons, and in the treatment of osteomyelitis of the calcaneus. Skin with tips of blood vessels of the musculi latissimus dorsi or the flesh and skin with tips of blood vessels from the musculus gastrocnemius and musculi capitis were also used in grafting to treat nearby positions, such as damaged skin and osteomyelitis of the shoulders or knees inflicted by firearms. This method is not limited by the traditional ratio of length and width of skin for grafting. The skin can be taken according to the needs of the injured area. The muscles and base of the skin can be completely excised with the tips of blood vessels for positioning at different angles in a versatile manner. A new method has thus been added in the latter period of treatment of men with injured limbs wounded in battle.

Vascular microsurgery was used to excise skin from the ilioinguinal regions and skin from the musculus gracilis to repair skin and muscles damaged by firearms and to rehabilitate the function of the limbs. Transplantations of various kinds of free skin were performed in 16 cases. There was one failure. The surgery can be completed in one attempt using this method, thus shortening the course of treatment and reducing the pain of the wounded patients. Rehabilitation of the functions was good, and the results of treatment were satisfactory.

Free transplanting of the fibula with blood vessels was performed in eight cases in order to repair damaged bones resulting from injuries by firearms. The results obtained were good. Because of the massive scar tissue and inflammation of the original wound, bones grafted by ordinary techniques of bone grafting do not easily stay alive. Free grafting of bone with blood vessels has changed this situation, so that the grafted bone's potential activity replaces the healing process and is converted to the healing process of a normal fracture, thus shortening the healing time of the grafted bone, and the chances that the bone will not heal are greatly reduced. The use of vascular micro-surgery during the latter period to repair skin and bone damage of the wounded in battle possesses great superiority as long as the indications and methods are grasped well.

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MAGNETIZED NEEDLE REMOVES SHELL FRAGMENTS FROM CRANIUM

Beijing JIEFANGJUN YIXUE ZAZHI [LIBERATION ARMY MEDICAL JOURNAL] in Chinese Vol 5 No 2, April 1980 pp 94-96

[Article by Wu Shengling [0702 5116 0134], Liu Wenbin [2692 2429 2430], Yuan Shunshu [5913 7311 2579], and Yi Shengyu [2496 5116 4416]: "Using a Magnetized Steel Needle Guide To Locate and Remove Shell Fragments From the Cranium"]

[Text] Remnant metallic fragments in the cranium resulting from wounds inflicted by firearms are more commonly seen in war. For some of the wounded men, these fragments were not removed when cleansing the wound during the early stage. Clinically, they do not frequently cause infection as remnant bone fragments, but according to the bacteriological examination of the metallic fragments removed from the cranium, most showed bacterial growth,[1] and there were many complications of encephalopyosis. Some statistics reached 10 to 13 percent.[2] Therefore, studying and improving the method of removing metallic foreign objects from the cranium are very important. In recent years, there have been reports[2] of successful use of stereoscopic locating methods in surgery. In June 1979, we began to use magnetized steel needles guided by stereoscopic locators. Experiments on animals were successful, and the method was used clinically. Shell fragments in the cranium were removed from wounded men in 14 cases. Except for the two cases which required the use of tongs to remove the foreign object, in all other cases the fragments were successfully extracted by the magnetized needle and the results were satisfactory.

INTRODUCTION TO DATA

1. Utensil. The domestically manufactured Model XZ-III stereoscopic locator for the brain was used. The magnetized needle was designed by our department and manufactured by a factory. Imbedded at the tip of the needle was a cylindrical piece of samarium-cobalt magnetized steel. There were a total of five specifications (Diagram 1). The data are listed in the accompanying table.

Accompanying Table - Five Specifications of the Magnetized Steel Needle Guide

1 Specification numbers
2 Outer diameter of needle guide (mm)
3 Outer diameter of magnetized rod (mm)
4 Magnetic strength (gauss)
5 Strength of magnetism (g)

2. Animal Experiments. The magnetized steel needles described above were all used in animal experiments before clinical use to observe their function and efficiency: (1) Shell fragments imbedded deeply (2 to 3 cm) inside the brain of a rabbit in surgery were successfully removed by magnetism of the No II to No V needles. The No I needle did not have a strong magnetic strength, and during the course of extraction the shell fragments dropped off easily. (2) the shell fragments held by the needle magnetically easily passed through the brain tissue, but they could not pass through the dura mater or muscular tissue. (3) In animal experiments, an envelope and scar formed around the fragments 2 months after implantation. Local brain tissues visibly underwent atrophy and hardened. The No V needle was able to remove the fragment and the envelope together, but when the other needles were used, the fragments easily dropped off. Experiments showed using the needle to magnetically remove shell fragments from the brain is feasible, and it is closely related to the strength of the magnet. The stronger the magnetic force, the more secure it is.

3. Clinical Data. This group included 14 cases, all male. Except for one 12-year-old, the others were all about 20 years old. There was a total of 20 shell fragments in the 14 cases (there were 4 cases with multiple fragments). The fragments were in the frontal lobe, temporal lobe, parietal lobe, and occipital lobe. Eight fragments reached a depth of 3.4 to 5 cm below the cortex, two fragments were at the bottom of the frontal indentation of the cranium, and the remaining fragments were all relatively shallow. Six cases were clinically shown to have suffered from partial paralysis or light partial paralysis, two cases suffered damage to the optic nerve, and many suffered headaches and dizziness. The earliest operation was performed in one case 18 days after the injury, but most cases were operated on about a half-year later. The latest operation was performed 14 months after injury. A total of 16 operations were performed in 14 cases. All successfully removed the shell fragments. There were no adverse reactions or complications after operation, and the symptoms did not worsen.

SURGICAL METHODS

1. Directional puncture

1) Presurgical preparation: This method was the same as ordinary craniotomy. After the patient was admitted to the hospital, he was given a full physical examination, an examination of the nervous system, an examination of the cerebrospinal fluid, an electroencephalographic examination, and pneumoencephalograms and cerebrovascular roentgenograms were taken to understand the conditions of the injuries and to judge the position of the shell fragment and its relationship to the surrounding nervous structure and blood vessels. Before the operation, the front and side views of the cranium must be taken to observe whether the shell fragment has shifted or not. The X-rays of four cases of this group prior to surgery (operated on 18 days after receiving injury) showed that the shell fragments had shifted by a larger extent. The patients were given tetanus antitoxic serum injections as standard procedure.

2) Anesthesia: Local anesthesia was administered to all patients of this group (for children and uncooperative patients, basal anesthesia or general anesthesia can be used in addition). The operation was conducted in combination with X-ray examination.

3) Locating: The position of the shell fragments was located by measurement according to the front and side views of the cranium shown in the X-ray photos or by fluoroscopy. The incision was marked. Attention should be given to selecting the closest distance, and the important functional areas of the brain must be bypassed.

4) Puncture of the cranial bone: The locator is installed to aim at the front or side positions or other particular position of the fragment, the spatial position of the shell fragment in the cranium is measured on the fluoroscopic spot film, and the angle of penetration and depth are calculated.

5) Operation: Based on the above-measured data, the coordinate angle of the guiding instrument is adjusted and the needle is installed. It is then inserted into the brain to a predetermined depth. When the needle approaches the shell fragment, the strong magnetic force causes the needle and the shell fragment to collide, producing a colliding sound, and adhesion is felt. When necessary, this can be confirmed by radiograms (Diagrams 2,3). If the envelope hinders extraction, the guide can be aimed at the foreign object, and a long insulated electrode can be used to produce electrical burning to destroy the envelope and extract the shell fragment magnetically.

2. Puncture by Hand

When the shell fragment is at a shallow position, or when there is difficulty installing the locator, the position and depth of the shell fragment can be determined from the X-ray picture and the target can be reached by manual operation of the needle. During the operation, repeated pictures can be taken or corrections can be made under Roentgenoscopy. This is not as accurate as installing a locator, but as long as the fragment is carefully located before the operation and as long as the incision and the punctured part are appropriate, the shell fragment can be extracted smoothly. This method was used in seven cases of this group (including two cases with shell fragments at the bottom part of the brain). It was fairly simple.

EXPERIENCE

1. Advantages and Indications in Using the Magnetized Steel Needle Guide to Remove Shell Fragments in the Cranium

In stereoscopic locating, the use of the needle to remove the shell fragments in the cranium is a simple and safe method with a high rate of success. A small incision of only about 3 cm is required. In stereoscopic locating, the target can be reached in one attempt. Shell fragments in envelopes may slip and fall off, but during the second attempt to retrieve it the original passage of the needle does not need to be changed. Therefore, additional damage is not inflicted. We have observed that the shell fragment always adheres to the magnetic needle on the end of its lengthwise axis. The surface of the fragment is always covered with a thin layer of fibrous tissue, reducing damage to the surrounding cerebral tissue of the passage. In this group, there were eight pieces of shell fragments located 3.4 to 5 cm below the cortex and two pieces located at the bottom part of the brain. All were successfully removed.

There were no adverse reactions in the 14 patients after the operation. All of them were able to consume food or get out of bed and move about on the same day the operation was performed. Nervous symptoms and body symptoms were not aggravated. The method is simpler and safer than traditional craniotomy to remove shell fragments. The earliest operation performed for the cases of this group was 18 days after receiving injury. Most of the remaining cases were operated on after 6 months. The latest operation was performed after 14 months, and the shell fragments were extracted

successfully. Therefore, this method not only is suitable for early wounds but also can be used on patients with a longer period of injury. In cases with multiple fragments in the cranium, the fragments can be removed all at once or in several operations, depending on the actual situation.

In the bacterial culture of the shell fragments from 11 cases, bacterial growth was present in 5 of the cases (albus staphylococcus, diphtheroid bacillus, staphylococcus tetragenus, and other gram-positive micrococci). Therefore, to eliminate latent diseases, treatment of the shell fragments in the cranium should be active. Except for shell fragments that are too small or are lodged deeply in important structures that should not be removed, this method can be used in most cases for removal.

2. Several Questions Worth Attention in the Operation

1) It is extremely important to locate the position of the fragment accurately before the operation. Accurate locating so that the bone puncture can be made nearest to the fragment facilitates removal and also reduces damage to cerebral tissues. There are many methods to locate foreign objects. The method we used was to accurately take standard front and side radiographic images of the cranium, select related bone marks according to the position of the shell fragment (such as the glabella, coronal suture, the bult at the external occipital position, the central line of the cranium, or a certain point on the rim of the damaged bone) as surgical marks, and measure the front, back, inner, and outer distances and depth of the fragment in the cranial cavity. But attention must be paid to the fact that the measured distance on the cranial bone in the radiogram is greater than the actual distance on the human body, and it should be divided by the magnitude of enlargement of the radiogram. A simple method of calculation is as follows:

Magnitude of enlargement of the radiogram (K) =

Radiographically measured distance (straight line between two marking points)

Straight-line distance measured on the head of the human body (between the same two marking points)

The relative parameters of the radiogram ÷ K = the actual relative parameter of the shell fragment in the cranium of the human body. An explanatory example is illustrated by the following:

Patient Liao had a shell fragment lodged behind the right temporal bone. The straight line distance from the large bulb at the external occipital position to the glabella was 7.1 cm on the profile radiogram, but the actual distance in the human body was 18.4 cm; thus $K = \frac{7.1}{18.4} = 1.15$. The position of the fragment measured on the front- and side-view radiograms was 7 cm in front of the large bulb at the external occipital position, 6.5 cm above the mastoidale, and 3 cm from the surface of the cortex behind the temporal bone. Thus, the relative distances of the shell fragment in the cranium of the patient were:

7 ÷ 1.15 = 6.1 cm; 6.5 ÷ 1.15 = 5.6 cm; and 3 ÷ 1.15 = 2.61 cm. The operation showed that the location was basically accurate.

2) Handling the envelope and the scar. Using the needle during the early period after injury, it is not difficult to extract the shell fragments in the cranium.

In cases of prolonged injury, the operation is affected by the envelope and the conditions of the local cerebral scars that have formed. Generally, shell fragments that penetrate the brain tissue and form a blind canal wound do not cause serious brain damage because of the weak penetrating force of the shell fragments. Not too much local scar is formed. The fragments can easily be extracted after they are loosened by collision with the needle. Fragments lodged at a deep position are sometimes much easier to remove. When extraction is difficult, the envelope can be destroyed by electrical burning. There were three cases in this group that had fragments which could not be removed after several attempts, but after electrical burning they were extracted smoothly. There was one case in this group that had a fragment in the right forehead. The fragment remained in the forehead at a shallow position (1.5 cm below the cortex), but the surrounding brain tissue was seriously bruised and split, forming a scar tissue, and the fragment was enveloped inside the scar. The needle was unable to remove the fragment, and the fragment had to be removed with tongs. In another case, the fragment was lodged in the supraorbital position and adhered to the meninx at the bottom of the cranium. It could be removed only with tongs.

3) In the operation (especially in a manual-puncture operation), there may be errors in locating and the target may not be located at once. It is best to make corrections under Roentgenoscopy. One must not blindly and repeatedly puncture the patient.

4) When encountering an inflamed and swollen area where the fragment is located, pus should be removed and the cavity repeatedly washed (using physiological saline and 3-percent hydrogen peroxide). An appropriate amount of penicillin and streptomycin (depending on the size of the cavity of pus, 50,000 to 100,000 units of penicillin or 0.125 to 0.25 grams of streptomycin can be used), or a catheter can be placed in the cavity for drainage. After the operation, treatment against infection should be intensified and changes in the condition must be carefully observed.

FOOTNOTES

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[Text] A New Species of Trematode of the Genus Epibathra Looss (Family Pronocephalidae).....Wu Guang [0702 0342; deceased], Institute of Parasitic Diseases, Shanghai; Zhang Songling [1728 2646 7881], Shanghai Museum of Natural History (3)

Five New Species of Monogenetic Trematodes from Freshwater Catfish of China.....Zhang Jianying [1728 0494 5391], Department of Biology, South China Normal College; Ji Guoliang [4764 0948 5328], Department of Fisheries, Central China Agricultural College (11)

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CSO: 4008

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9717
CSO: 4008

AUTHOR: None

ORG: Central Design Institute, First Ministry of Machine Building; Research Institute of Building Structures, Chinese Academy of Building Research; Beijing First Building Elements Factory

TITLE: "Scheme and Experimental Research of a Monolithically Joined Prefabricated Continuous Beam-Slab Structural System"

SOURCE: Beijing JIANZHU JIEGOU XUEBAO [JOURNAL OF BUILDING STRUCTURES] in Chinese Vol 2 No 1, 5 Feb 81 pp 8-14

TEXT OF ENGLISH ABSTRACT: This paper introduces a monolithically joined prefabricated continuous beam-slab structural scheme (the precase beams and slabs are connected monolithically to each other by cast-in-place joints to form a monolithic structural system) for one story industrial buildings with underhung crane and column grids of 12 x 12, 12 x 15 and 12 x 18 m. A brief illustration of the experimental results carried out on this structural scheme is presented which shows that such a scheme is applicable in engineering practice. This recommended scheme is also useful for the improvement of beams and columns of prefabricated multistory frame structures.

AUTHOR: None

ORG: Research Institute of Building Structures, Chinese Academy of Building Research; Wuxi Building Construction Company; Wuxi Architectural Design Office; Jiangsu Building Research Institute

TITLE: "Unbonded Post-tensioned Grid Slab Floor System with a Suspended Mezzanine Underneath Constructed by the Lift-Slab Method"

SOURCE: Beijing JIANZHU JIEGOU XUEBAO [JOURNAL OF BUILDING STRUCTURES] in Chinese Vol 2 No 1, 5 Feb 81 pp 15-20

TEXT OF ENGLISH ABSTRACT: This paper introduces an unbonded post-tensioned grid slab floor system with a suspended mezzanine underneath for ventilation installations constructed by the lift-slab method. The beams adjacent to the columns are continuous double beams reinforced with unbonded post-tensioned tendons; the interior beams are ordinary reinforced concrete continuous beams; the suspended mezzanine is a reinforced concrete slab with a thickness of 8 cm suspended by steel rods at the beam intersections and is lifted up simultaneously with the upper floor.

In this paper a multistory building of the First Textile Factory in Wuxi is taken as an example to present the design and construction methods of the above-mentioned floor system.

AUTHOR: JIN Wenlu [6855 0795 7627]

ORG: Design Institute of Hangzhou

TITLE: "Generalized Variational Principles of Cable Nets and Their Applications"

SOURCE: Beijing JIANZHU JIEGOU XUEBAO [JOURNAL OF BUILDING STRUCTURES] in Chinese Vol 2 No 1, 5 Feb 81 pp 21-39

TEXT OF ENGLISH ABSTRACT: In this paper, by utilizing the idea of generalized stress and deformation, the generalized variational principles of cable nets are derived, then the triangular elements are used to work out the finite elements formulation of the cable nets and a representation of the rigidity matrix and load matrix as well as the iterational process of nonlinear problems are given. In the appendix, a rigidity matrix representation of a boundary member, such as the curved beam, is presented. By combining the rigidity matrix of the cable nets with that of the curved beam, the internal action between them is thus taken into consideration. From dynamics, vibration and phenomenon of jump are investigated. From the numerical examples, it is observed that the influence of internal action between cable nets and curved beams is very important in the analysis.

AUTHOR: None

ORG: Steel Tower Research Group

TITLE: "Research on Dynamic Responses of a Quadrilateral Steel Tower"

SOURCE: Beijing JIANZHU JIEGOU XUEBAO [JOURNAL OF BUILDING STRUCTURES] in Chinese Vol 2 No 1, 5 Feb 81 pp 40-46

TEXT OF ENGLISH ABSTRACT: Three methods of theoretical dynamic analysis for a steel tower are conducted: (1) space-truss-multimass dynamic system calculated by the method of mode analysis; (2) space truss dynamic system calculated by the same method; (3) space-truss-multimass dynamic system, the response of which is calculated by inputting the earthquake record. For verifying the results of the analysis, two other methods of dynamic test on the prototype structure are also made: (1) forced vibration carried out by vibrators; (2) microseismic measurement recorded by a graph and by magnetic tape and analyzed by a signal-processor. The results of different methods of analysis and tests are compared in the paper.

AUTHOR: QI Zhicheng [7871 1807 2502]

ORG: Hunan Architectural Research and Design Institute

TITLE: "The Calculation of Spiral Stairways"

SOURCE: Beijing JIANZHU JIEGOU XUEBAO [JOURNAL OF BUILDING STRUCTURES] in Chinese Vol 2 No 1, 5 Feb 81 pp 47-59

TEXT OF ENGLISH ABSTRACT: Equations for solving spiral stairway beams and slabs fixed at both ends or fixed at one end and hinged at the other end are derived by using vector algebra. Some precautions in the detailing of reinforcements are also given in this paper.

The method presented in the paper is conceptually clear, the derivation being simple and easy to comprehend. It is also applicable to other single-span curved beams in space.

AUTHOR: ZHANG Qingbo [1728 3237 3134]
GUO Kejun [6753 0344 0193]
LEI Youguang [7191 2589 0342]

ORG: ZHANG of the Hunan Computing Center; GUO and LEI both of the Eighth Design Institute, First Ministry of Machine Building

TITLE: "Optimization of the Depth of Reinforced Concrete Column Cross Sections of Hinged Bent Structures by a Complex Method"

SOURCE: Beijing JIANZHU JIEGOU XUEBAO [JOURNAL OF BUILDING STRUCTURES] in Chinese Vol 2 No 1, 5 Feb 81 pp 60-68

TEXT OF ENGLISH ABSTRACT: In reinforced concrete columns of hinged bents widely used in single-story industrial buildings, a complex method has been adopted to find the optimal depth of various cross sections of all columns. The purpose of this method is to try to reduce the total cost of all columns under various loads and constrained conditions to a minimum.

Eight examples are given in this paper, indicating that the total cost of all columns after optimization by using the complex method will be decreased by 2-23 percent as compared with the original designs.

AUTHOR: QIAN Lihang [6929 0500 5300]
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ORG: QIAN of the Chinese Academy of Building Research; HUANG of the Shanghai Geological Department; FANG of the Shanghai Municipal Institute of Civil Architectural Design; ZHANG of the Shanghai Institute of Industrial Architectural Design

TITLE: "An Analysis and Discussion of the Influence of the Superstructure Rigidity upon the Integral Moment of Box Foundation"

SOURCE: Beijing JIANZHU JIEGOU XUEBAO [JOURNAL OF BUILDING STRUCTURES] in Chinese Vol 2 No 1, 5 Feb 81 pp 69-77

TEXT OF ENGLISH ABSTRACT: Based on a number of calculations by computer and measurements of stresses in the reinforcements of box foundations in the field, the influence of the superstructure rigidity on the integral moment of box foundations are analyzed in this paper. The calculation methods of box foundations under frame structures and under shear wall structures are given separately. As for the box foundations under frame structures, a simplified calculation method with consideration of the influence of the superstructure rigidity by the equivalent beam method is proposed, and it is proved that it is sufficiently accurate. The equivalent beam formula given by G. G. Meyerhof in 1953 is examined and improved.

[Continuation of JIANZHU JIEGOU XUEBAO Vol 2 No 1, 5 Feb 81 pp 69-77]

It is recommended to use the improved equivalent beam formula to calculate the rigidity of rigid frame structures.

9717
CSO: 4009

AUTHOR: WU Baosheng [6762 1405 3932]

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TITLE: "Essential Measures for Improving Production Efficiency of Plateau Engineering Machines"

SOURCE: Tianjin GONGCHENG JIXIE [CONSTRUCTION MACHINERY AND EQUIPMENT] in Chinese No 2, Feb 81 pp 54-58

ABSTRACT: The Qingzang Railway [Qinghai Province to Xizang Province] is located on the Qingzang Plateau. Compared to the inland regions, the elevation is above 3000 m, the atmospheric pressure is low, (averaging 400-530 mm of mercury for the entire railway line) and the air contains less oxygen. There is a long stretch of frozen earth, amounting to 47 percent of the line. These and other adverse natural conditions cause the labor productivity to be low while the capability of the machinery also drops severely. This paper reports measures adopted to overcome the problem of reduced efficiency of diesel engines and low temperature ignition, to improve the operating efficiency of ventilators and air compressors, and to strengthen management, maintenance, and repair of machines.

AUTHOR: QIU Xianzhen [6726 6343 2823]

ORG: Beijing Municipal Government Machinery Company

TITLE: "Brief Introduction of Small Vibrating Steamroller"

SOURCE: Tianjin GONGCHENG JIXIE [CONSTRUCTION MACHINERY AND EQUIPMENT] in Chinese No 2, Feb 81 p 62

ABSTRACT: Vibrational road rollers have the good effect of compacting the soil and are light and easily maneuverable. They are now being extensively used in road construction. The company has successfully made 2 models: GZ-40-1 and GZ-40-2, of vibrational road rollers, powered by diesel and gasoline engines respectively. Both of these have been tested more than 200 hours on work sites to prove that they meet the design requirements. A table comparing their various technical parameters with the Japanese-made road roller, MDRT38 is included in the paper.

AUTHOR: HAN Qishan [7281 1477 1472]

ORG: Nenjiang District Institute of Forestry, Heilongjiang Province

TITLE: "5 m^3 Lift Type Motorized Shovel Briefly Introduced"

Source: Tianjin GONGCHENG JIXIE [CONSTRUCTION MACHINERY AND EQUIPMENT] in Chinese No 2, Feb 81 p 63

ABSTRACT: The Nenjiang District Institute of Agricultural Machinery, Heilongjiang Province has successfully made the CQS-5 lift type motorized shovel, designed to be pulled by the Dongfanghong-75 caterpillar tractor. It is moved by the engine of the tractor, with the 3-stage gear system for transmission. The forward thrust greatly reduces the resistance of the dirt and increases the volume of the shovel. The tail end of the machine is equipped with a dirt loosening tool with teeth to loosen the dirt to lessen the resistance for the shovel. The paper includes the major technical parameters of the shovel as well as a photo of the shovel being pulled by the caterpillar tractor.

AUTHOR: ZHOU Wanlong [0719 8001 7893]

ORG: None

TITLE: "Improvement to the Up and Down Pin Rod of the Cart of Jiefang Self-Unloading Truck"

SOURCE: Tianjin GONGCHENG JIXIE [CONSTRUCTION MACHINERY AND EQUIPMENT] in Chinese No 2, Feb 81 p 64

ABSTRACT: The cart of SP-340 self-unloading truck often has trouble moving up and down by itself. It is generally believed that the problem is caused by either the grease seal or the power takeoff device, but the author and his colleagues believe that the important factor is the design problem of the up and down pin rod. The original design is described to explain what the problem is believed to be. A new pin rod has been designed to replace the old one. The cart with the reconstructed pin rod mechanism has been in use for many years and the old problem does not occur easily any more. Schematic diagrams are included to demonstrate the difference between the old and the new design.

6168
CSO: 4009

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ORG: Beijing Institute of Technology

TITLE: "Optimal Processing of Space-Time Radar Signal"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 1, 1981 pp 1-10

TEXT OF ENGLISH ABSTRACT: The optimal processing of the multi-parameter space-time sampled radar signal is discussed using the vector space approach. It is shown that the optimal processing system is a space-time matched system and is the extension of the classical theory. The signal detectability of that system is determined mainly by the signal-to-noise ratio, and the accuracy of parameter estimation is also related to the characters of the generalized ambiguity function.

AUTHOR: ZHOU Erben [0719 1422 2609]
ZHAO Zhongxiang [6392 0112 4382]

ORG: Both of the Wuhan Research Institute of Shipboard Communications

TITLE: "The Construction of Multi-criterion Concurrently-optimal Nonsystematic Convolutional Codes and the Results of Computer Searches"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 1, 1981 pp 11-19

TEXT OF ENGLISH ABSTRACT: This paper presents some multi-criterion concurrently-optimal (2, 1, 31) and (3, 1, 31) nonsystematic convolutional codes for sequential decoding. These codes are constructed with a computer using an algorithm of constructing nonsystematic convolutional codes found by Zhang Zhaozhi. Some of the convolutional code generators are given. The minimum distance $d_c(m)$ and column distance profile $d_c(0, h)$ of these codes are found to be optimal. The tree distance d_t of the (2, 1) code is made up to 29-30, and of the (3, 1) code up to 27-29. All of the multi-criterion concurrently-optimal nonsystematic convolutional codes presented in this paper are intransparent with the greatest column hyperdistance $\overline{d}_c(n)$ so that we will be able to reduce the computational requirements for recognizing the 180° phase-ambiguity in sequential decoding. The (3, 1, 31) nonsystematic code presented in this paper has concurrently-optimal performances for both 1/2 and 1/3 coding rates.

AUTHOR: LIU Shenggang [0491 4141 4854]

ORG: Chengdu Institute of Radio Engineering

TITLE: "On the Two Methods of Kinetic Theory of ECRM"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 1, 1981 pp 20-25

TEXT OF ENGLISH ABSTRACT: A detailed investigation on the two methods of kinetic theory of ECRM is given in this paper. One of them, based on integration in the waveguide coordinate system, was presented by the scientists of NRL of America, and the other, based on the local field expansion in the electron guiding center coordinate system, was proposed by the author of the present paper. After detailed analysis and comparison, the paper points out that the latter one has some advantages over the first one; its approach is simpler and more direct and it has more explicit physical meaning. Furthermore, it makes the electron equilibrium [illegible] distribution functions simpler.

AUTHOR: YANG Xiaodong [2799 2556 2639]

ORG: Changsha Institute of Technology

TITLE: "Fault Function Method and Its Application"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 1, 1981 pp 26-32

TEXT OF ENGLISH ABSTRACT: This paper presents a new diagnosis method of digital [illegible]--the Fault Function Method. By means of a graph theory, the fault detection, "single fault" location and the multiple fault location as well as the combinational logic and the sequential logic processes are all unified. This method also gives the rule forming the minimal set of tests. The assumptions of single fault and fault simulation are eliminated.

AUTHOR: ZHOU Ninghua [0719 1380 5478]
GONG Yanzhao [7895 1693 2507]

ORG: Both of the Beijing Institute of Aeronautics and Astronautics

TITLE: "Emitter Feedback Data Amplifier

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 1, 1981 pp 38-46

TEXT OF ENGLISH ABSTRACT: This article analyzes and discusses the design features of an improved emitter feedback data amplifier with excellent technical characteristics. Its temperature drift of input offset voltage is not greater than 0.5 $\mu V/^{o}C$. The linearity of closed loop gain is not worse than ± 0.01 percent. The common mode rejection ratio reaches 30 dB. The closed loop differential mode input resistance is no less than 1000 M. The effective low frequency input voltage noise is not larger than 1 μV(p-p) in 0~2 Hz.

These characteristics have been gained through a simply-constructed circuit based on advanced principles. The whole amplifier can be easily divided into several independent sections. As a result, except for a few components, it can not only be integrated monolithically, but can also be assembled with multichip integrated circuits. At the same time, it can also be assembled hybridly with discrete components and integrated circuit operational amplifier easily. All these advantages will make this data amplifier the best circuit in the data acquisition system.

AUTHOR: JIANG Renpei [5592 0088 1014]
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ORG: Both of Nanjing Electronic Technology Institute

TITLE: "A Variating-Polarization Circulator"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 1, 1981 pp 47-53

TEXT OF ENGLISH ABSTRACT: A new kind of variating-polarization circulator on the principle of nonreciprocal variating polarization is introduced in this paper. It is magnetized with a quadrupole magnetizing field and its structure is simple and compact; the average power is not less than 400 W; and its behavior can be compared with the conventional four-port waveguide circulator. The main part of the variating-polarizator is a section of square waveguide in which four pieces of ferrite are placed on centers of the waveguide walls symmetrically while a piece of dielectric slab is placed in the space of the waveguide diagonally. All together they form a nonreciprocal variating polarizator.

AUTHOR: DU Maochang [2629 2021 2545]
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ORG: Wuhan Research Institute of Posts and Telecommunications

TITLE: "Optical Fiber Fault Location with Photon Probe"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 1, 1981 pp 54-60

TEXT OF ENGLISH ABSTRACT: As an alternative to the optical pulse reflection method based on the principle of optical radar, the "photon probe" offers the possibility that the extremely weak echo from a broken point with any poor fracture or certain imperfection can be detected. The "space-separation" effect has been observed in our research and analyzed. The display of fault location is digitized with the "external time-base method" suggested in this paper, thus bringing the accuracy of fault location to the limit of the pulse reflection method. The fracture of a 1345 m gradient fiber with a total attenuation of 9.3 dB and NA 0.21 has been measured.

AUTHOR: WEI Cejun [7614 4595 6511]

ORG: Institute of Semiconductors, Chinese Academy of Sciences

TITLE: "Principle and Analysis of Transistor Delayed Injection and Transit Time Device"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 1, 1981 pp 61-69

TEXT OF ENGLISH ABSTRACT: The analysis of a transistor delayed injection and transit time device is given in this paper. Its configuration is similar to that of a conventional transistor with the exception of the addition of a ν or π layer [illegible] region between the collector and base regions and it is operated as a diode. The negative resistance and the noise performances are calculated by means of a small signal theory. The large-signal performances are also approximately described. It is shown that output power of about one watt as well as [illegible] high efficiency can be obtained at the X-band, and the measured noise is about 10 dB less than that of IMPATT.

AUTHOR: LING Xieting [5677 3610 0080]

ORG: Department of Physics, Fudan University

TITLE: "Fault Analysis of Nonlinear Analog Circuits"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 1, 1981 pp 70-77

TEXT OF ENGLISH ABSTRACT: In this paper a method for the fault analysis of nonlinear analog circuits is introduced and the solvability of the fault equation is also discussed.

AUTHOR: QIAN Huisheng [6929 1920 3932]
JIANG Changlun [5592 2490 0243]

ORG: Both of the Nanjing Electronic Technology Institute

TITLE: "An Improvement on Hardware Design for Eliminating Velocity Ambiguity"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 1, 1981 pp 78-82

TEXT OF ENGLISH ABSTRACT: An analysis of the principle of the velocity ambiguity eliminator used in early instrumentation radar has shown that the smoothing time required is too long. The optimum algorithm used as software in the radar system is analyzed and it is found possible to reduce the smoothing time. A new hardware design is developed which, by using the approximate optimum algorithm, has made the smoothing time approach the computing time by software in a general computer. An improvement is made on the hardware design for eliminating velocity ambiguity, and in this case the time required is about one-fourth that of the old designs.

AUTHOR: ZENG X.zhi [2582 6932 0037]
SHEN Anshi [3088 1344 4258]

ORG: Both of the Wuhan Institute of Physics, Chinese Academy of Sciences

TITLE: "Measurements of Phase Variations in Frequency Multipliers"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 1, 1981 pp 83-88

TEXT OF ENGLISH ABSTRACT: Certain practical guidelines and design methods for getting optimal characteristics in frequency multipliers are considered, and one of the frequency multiplying circuits in atomic frequency standards is given. The phase drift at the 90 MHz output of the (x18) frequency multiplier is measured with a phase drift measurement set-up made during the study. The results show that phase drift $\Delta\Phi = 14^{o}$ when the ambient temperature varies from $30^{o}C$ to $50^{o}C$; $\Delta\Phi = 4.7$ when the supply-voltage varies from 20 V to 22 V. The phase noise in the multiplier is also measured with another multiple-period measurement set-up with single sideband mixing designed by the authors. Results show that the fractional frequency error due to phase noise in the multiplier is 1.1×10^{-12} when the average time $\tau = 1$ sec, and the fractional error is 3.9×10^{-13} when the average time $\tau = 10$ sec. A simple method of single sideband mixing in the frequency multiplier is observed and explained.

AUTHOR: TONG Shi [4547 2514]

ORG: Xian Institute of Radio Technology

TITLE: "High Resolution Single-tube Color TV Camera System"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 1, 1981 pp 94-97

TEXT OF ENGLISH ABSTRACT: Theoretical and experimental results are presented of a new high-resolution single-tube color TV camera system using the spectrum interleaving technique. In this system the vertical correlation principle is utilized with color stripe filters inclined to the line scanning direction. The output signals of the pick-up tube are electrically separated by a comb filter. As a result, luminance signals of high resolution and chrominance signals of low resolution are obtained. Finally, experimental results are given of 550 TV line horizontal resolution.

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ORG: All of the Department of Physics, Beijing University

TITLE: "Bandspread of the C-Band Latching Nonreciprocal Ferrite Microstrip Phase Shifter"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 1, 1981 pp 94-97

TEXT OF ENGLISH ABSTRACT: An experiment for broadening the bandwidth of a ferrite microstrip phase shifter is reported. In order to decrease the insert loss and VSWR, the ratio $4\pi Ms/L$ should equal a constant. If a suitable substrate of higher $4\pi Ms$ is chosen and gap width S is increased, the difference of the phase shift angles $\phi_{max} - \phi_{min}$ can be decreased. The magnetic substrate with low anisotropy field must be selected to prevent the insert loss from increasing at the low end of the frequency band. It is possible that the bandwidth can be 20 percent of the central frequency.

AUTHOR: TIAN Bing [3944 0365]

ORG: None

TITLE: "Non-parametric Binary Rank Detector"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 1, 1981 pp 98-100

TEXT OF ENGLISH ABSTRACT: The principle of the non-parametric binary rank detector and its performance is described. A prototype of the digital detector has been designed and tested on the sea surface. The results of the surface tests, given in the paper, demonstrate the non-parametric performance of the detector. If it is used in noncoherent radar it will increase its capability in detecting targets in a cluttered background.

AUTHOR: DING Zhongqi [0002 6945 3823]

ORG: Department of Electrical Engineering, Hunan University

TITLE: "A Study of Transistor RF Amplifier Blocking"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 1, 1981 pp 101-104

TEXT OF ENGLISH ABSTRACT: Transistor blocking is investigated using a hyperbolic function. A general expression is obtained showing the effect of interference on the useful output and methods of raising the blocking level are discussed.

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CSO: 4009

AUTHOR: CHEN Renfu [7115 0088 3940]

ORG: Assistant Researcher, the 1932 Research Institute, Ministry of Machines No 4

TITLE: "Effects of Large-Scale Integrated Circuit Technology on Computers"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 1, Jan 80 pp 4-5

ABSTRACT: Vacuum tubes, transistors, and integrated circuits represent three generations of progress in computers. The fourth generation has now started with large-scale integrated circuits. In the past several years, this change has been further accelerated and as far as computers themselves are concerned the effects are reflected mainly in (1) more rapid changeover of machinery; (2) terminal capabilities of equipment; (3) extensive applications in processing. The technology of large-scale integrated circuit (LSI) did not begin until the seventies. Now it is marching toward ultra-large-scale integration, doubling the function every year, while cutting the price in half. LSI memory chips have replaced the magnetic core memory. Combined with logic units, now logic components with more than 500 gates have appeared. Recent announcements concerning advanced computers by IBM regarding its 4300 series, by the Ahmdal Company, and by unnamed Japanese companies are briefly summarized and discussed.

AUTHOR: WANG Yangyuan [3769 7122 0337]
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TITLE: "Polymorphic Silicon Thin Film in Large-Scale Integrated Circuit"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 1, Jan 80 pp 12-16, 29

ABSTRACT: The technology of polymorphic silicon is being more extensively applied in recent years. In MOS it increases the degree of integration; in SIPOS it raises the stability and reliability of the device. This paper discusses its growth structure, microstructure, and directional characteristic, diffusion of foreign matter in polymorphic silicon, and oxidation of polymorphic silicon. Such aspects as aluminum-polymorphic silicon, polymorphic silicon-SiO_2, and polymorphic silicon-silicon, relating to the interface phenomenon and its application, are not included in the discussion of the paper. This paper is to be continued.

AUTHOR: HUANG Zhipeng [7806 1807 7720]

ORG: None

TITLE: "Condition of Experiment of the Satellite Television Conference Utilizing the Symphony Satellite"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 1, Jan 80 pp 30-31

ABSTRACT: The satellite television conference is a form of communication introduced in recent years. It is even better than the ground surface microwave television conference, suitable for conducting domestic as well as international meetings. Last year, the STS conference in the USA was held in eight sites utilizing CTS and AIS-6 satellites. In cooperation with Symphony Satellite and with the help of the Ministry of Post and Telecommunications, the Central Bureau of Broadcasting Industry, etc. four television conferences were attempted as an experiment with ground surface stations in Nanjing, Beijing, Shanghai, and a city in West Germany. Opinions concerning technological cooperation between China and West Germany in such areas as the Symphony Satellite experiment, satellite communication, direct broadcast satellite, laser communication, solar energy utilization, etc. were exchanged in living color. Although the participants were physically thousands of miles apart, during the 2-3 hours of conference time, they felt like they were talking to one another person to person. Organization and transmission procedures of the conference are reported.

AUTHOR: ZHAO Baojin [6392 0202 4842]
LU Minfeng [6424 3046 1496]

ORG: None

TITLE: "Introducing Series of Products of TTL Digital Integrated Circuits Made in China"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 1, Jan 80 pp 38-40, 42

ABSTRACT: This is the first chapter of the paper, entitled "A General Discussion of Series of Small-Scale Circuits." A total of 109 types divided into 5 series are listed. For the purpose of recommending these products, the paper explains the three typical structural forms of antisaturation, light saturation, and saturation structures. The problem of input and output clamping diode, and the collector open-circuited (OC gate) gate are explained. This paper is to be continued.

AUTHOR: ZHANG Qijun [1728 0366 3449]

ORG: Professor of Yunnan University

TITLE: "On Han Character Encoding Problems"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 2, Feb 80 pp 5-6

ABSTRACT: The rapid progress of electronic computers has made numerical computation so fast, almost a hundred million calculations per second, but the problem of Han character input still does not have a good solution. The application of computers in processing Han language data therefore remains limited. With Western languages, letters of the alphabet are linked together to denote sound and letters may be outputed sequentially to form words. In the Han language, strokes (forms) are linked together to form characters, and the relative position of the elements (strokes) must be adhered to strictly in order to complete a desired character. Three ways are, therefore, open in the problem of processing Han language data: through the sound, through the form, or through the sound and the form simultaneously. A number of schemes have been proposed, and many specialists have performed a great deal of work on the subject. This paper reports only an attempt in the approach through the form of the Han character. A principle of dissecting Han characters and classifying them is suggested.

AUTHOR: JIANG Li [1203 0196]

ORG: None

TITLE: "International Communications Satellite of the Future"

SOURCE: Being DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 2, Feb 80 pp 7-8

ABSTRACT: This paper traces the history of the Intelsat series sponsored by the International Telecommunications Satellite Consortium, which began with 14 members in 1964 and grew to 103 members today. Four satellites, Intelsat I, II, III, and IV have been launched, and Intelsat V is expected to be launched in 1980. The work plans, the properties, and the ground surface stations of Intelsat are reported.

AUTHOR: YANG Zhongxiang [2799 0022 4382]

ORG: None

TITLE: "Superconductive Computer"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 2, Feb 80 pp 9-11

ABSTRACT: A superconductive computer has been developed based on the fact that some materials demonstrate superconductivity under the condition of ultra-low temperature. The IBM Company of the USA is the leader regarding research on superconductive computers. Researchers of that company think the future superconductive computer should have a main machine which will include the central processor, input/output channels, high speed buffer storage, and the main storage, with an estimated speed of 7,000 instructions/second. The basic work theory and the current stage of development, and names of USA companies and Japanese companies and agencies currently working on superconductive computer projects are reported. There is a table comparing the properties of the future superconductive computer with those of the large IBM 370/168 computer.

AUTHOR: WANG Yangyuan [3769 7122 0337]
HAN Ruqi [7281 3067 3823]
JI Lijiu [0679 0500 0036]
ZHANG Lichun [1728 0448 2504]
NI Xuewen [0242 1331 2429]

ORG: All of Beijing University

TITLE: "Polymorphic Silicon Thin Film in Large-Scale Integrated Circuit"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 2, Feb 80 pp 28-31

ABSTRACT: This, the second installment of the paper contains the following chapters: (5) Resistance rate of polymorphic silicon; (6) Mobility rate of polymorphic silicon [Hall mobility]; (7) Ion implantation of polymorphic silicon; (8) Laser annealing of polymorphic silicon. The entire paper is completed with this installment.

AUTHOR: WEI Zhaohua [7614 3564 5478]

ORG: Tianjin Institute of Television Technology

TITLE: "Faint Light Television"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 2, Feb 80 pp 41, 39

ABSTRACT: Faint light television is a special industrial television, depending mainly upon moonlight, starlight, airglow, etc. for luminescence. It is known experimentally that the human eye can adjust to direct sunlight as well as starlight at night, the object of research on faint light television is to improve the range of night vision of the human eye. That is to say the television camera can be made better than the night vision of the human eye in the following aspects: (1) using photocathode to raise the quantum efficiency more than 10 times higher; (2) processing the frequency, brightness, etc of the electrical signal before displaying to improve the picture quality and to enable pictures to be recorded and stored; (3) transforming motions under weak light into brilliant pictures and accumulating momentary information. The work theory of faint light television and ways of achieving ultra-high sensitivity are explained.

AUTHOR: ZHAO Baojin [6392 0202 4842]
LU Minfeng [6424 3046 1496]

ORG: None

TITLE: "Introducing Series of Products of TTL Digital Integrated Circuits Made in China"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 2, Feb 80 pp 42-45

ABSTRACT: This installment contains the second part of the paper dealing with J-K Trigger. A table is included to list the types, serial numbers, and parameters of J-K triggers in the 5 series of TTL integrated circuits made in China. The low power loss, low speed J-K triggers and the low power loss, medium, high, and very high speed J-K triggers are described with respect to their circuit form, property characteristics, work theory, and essential principles of design. The balance of the paper explains typical applications of J-K triggers as counter circuit, as data comparator, as "1" detector, etc. The paper appears to be completed.

AUTHOR: MAO Peifa [3029 1014 3127]

ORG: Northwest College of Telecommunications Engineering

TITLE: "Design of XD521 High Speed Voltage Comparator Circuit"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 1, Jan 81 pp 17-18, 38

ABSTRACT: A voltage comparator is one of the key devices of signal processing. It is used mainly to distinguish the minute difference between 2 voltages, and to provide the result in the form of a digital signal. Due to the fact that the signal voltage being monitored often changes very fast, the 2 basic technical parameters of the comparator are its sensitivity and response time. The 2 types of comparators, BG307 and 4E323 currently being produced in China are imitations of the 2 foreign makes of μA710 and μA711. Due to the problem of saturation in the circuit itself, their response time is 30-150 ns and their high speed application is thus limited. The author and colleagues made an unsaturated high speed voltage comparator circuit, and named it XD521. Its response time is about 10-30 ns. Its sensitivity with regard to 20 MHz square wave is better than 10 mV, and its high frequency sensitivity is obviously better than BG307 and 4E323. Its structure and major parameters are discussed.

AUTHOR: G. Deren [7357 1795 0088]

ORG: Chengdu College of Telecommunications Engineering

TITLE: "Speed up Training of Electronics Specialists According to Objective Principles"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 1, Jan 81 p 31

ABSTRACT: For the past 2 decades, electronics has been one of the fastest developing technologies. With the extensive application of computers and the successful manufacture of integrated circuits, electronics has now infiltrated every department of the national economy. It has become one of the major measurements of the level of science, technology, and industrialization of a country. Whether or not China can train electronic specialists in sufficient numbers will directly affect China's realization of four modernizations. The current training arrangement does not coincide with this objective, however, mainly in the following 3 aspects; (1) Division of electronic specialties in schools of higher education is too detailed to allow comprehensive applications of several technologies; (2) Deficient background knowledge of students in natural sciences; (3) Insufficient training of students in experimental techniques. The author proposes several measures to overcome these shortcomings.

AUTHOR: (1) ZHI Xiangji [2388 4382 0679]
AI Bolin [5337 2672 2651]
(2) XING Yulong [6717 3022 7893]
LI Rongchun [2621 2837 2797]
(3) LIAO Bin [1675 1755]

ORG: None

TITLE: "Work Processes and Equipment"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 1, Jan 81 pp 41-42

ABSTRACT: Three short items are presented in the paper: (1) New work process for retaining edge of capacitor electrode--the reverse evaporation edge retaining method, designed for metallized organic medium thin film capacitors; (2) Printed circuit board both sides dual frame automatic light exposure machine, with the automatic control of the exposure procedure realized by relay logic circuit; (3) ZS-2000D electromagnetic vigration test device, made by Suzhou Experiment Instrument Plant, capable of serving as the source of vibration in the laboratory to simulate a vibration environment for components, parts, or structural members receiving vibration of different frequencies and acceleration in the actual use process.

AUTHOR: MA Junming [7456 7486 7686]

ORG: Beijing broadcasting Instruments and Materials Plant

TITLE: "A New Type Electronic Equipment for Cancer Treatment--the 2 kw High Frequency Thermal Therapy Machine"

Source: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 1, Jan 81 pp 43-45

ABSTRACT: Recently, medical scientists of the world have rekindled their interest in an ancient thermal therapy method and have been carrying out experimental studies and clinical research on its application for the treatment of mankind's most stubborn disease, cancer, and on its execution with new technical instruments. Current results indicate that high frequency magnetic energy may be used to add heat to tumors as a treatment in coordination with small dosage radiation therapy to produce effects of suppression and even remission of tumors. In July 80, an international conference (the third) on heat, drug, and radiation treatment of cancer was held in the USA. This paper introduces the 2 kw high frequency thermal treatment machine, successfully made in March of last year and its subsequent improvements. The circuit theory, the structural characteristics, and the essential application procedure are explained.

6248
CSO: 4009

AUTHOR: WANG Jinhan [3769 6855 3352]

ORG: Shanghai Institute of Computer Technology

TITLE: "Computer and Modernization of Industrial Management"

SOURCE: Shanghai DIANZI JISHU [ELECTRONIC TECHNOLOGY] in Chinese No 1, 20 Jan 81 pp 1-4

ABSTRACT: The electronic computer is a modern computation tool. Many comrades have by now understood and acknowledged its applications in scientific research and engineering design. Its use as a tool of processing information to bring about modernization of industrial management has barely begun in China, however. The power of a computer is in its ability to make fast calculations, possess a very large memory, make fast logical judgments, etc. All these are functions desired in industrial management. The paper explains that industrial management is in reality data management; therefore, computers can be used for selecting the optimal plans, finding missing parts or weak leaks, managing warehouse and inventories, formulating cost, profit, and distribution plans, managing tools, equipment renewal, and plant expansion, managing sales activity and market forecasts, managing documentations of products, parts, workers' welfare programs, operating procedures, etc. A chapter of the paper is devoted to selecting suitable computers and softwares for industrial management.

AUTHOR: WEN Xianli [3306 2009 4539]

ORG: None

TITLE: "Brief Introduction of Han Character Terminal Display Device"

SOURCE: Shanghai DIANZI JISHU [ELECTRONIC TECHNOLOGY] in Chinese No 1, 20 Jan 81 pp 5-8

ABSTRACT: In Han language data processing systems, a Han character terminal display system is an indispensable component, which enables Han characters to be displayed directly and used directly to converse between the machine and the operator. At present, if the ordinary television scanning technique is adopted for the purpose, it would not be able to share the language generator. The author and colleagues add more scanning strokes to form a scheme of scanning one character at a time. A 12-inch CRT is used for the display device, and the screen is designed to display 16 lines of 22 Han characters per line. The display device is composed primarily of the address storage, the Han character internal code storage, the character mold storage, the time sequence control, and the scanning circuit. The time required to scan each character is 33/352 - 94 usec, and time to scan 5 lines is 94/5 - 19 usec. The longest waiting time is, therefore, 19 x 2 - 12 = 26 usec. The structure and theory of the components are explained.

AUTHOR: SUN Jiliang [1327 4949 0081]

ORG: Shanghai Electrical Meter Plant

TITLE: "JZPC-01 Soft Magnetic Disk Driving Device"

SOURCE: Shanghai DIANZI JISHU [ELECTRONIC TECHNOLOGY] in Chinese No 1, 20 Jan 81 p 43

ABSTRACT: The JZPC-01 soft magnetic disk driving device is a new random access, digital magnetic recording device. It is compact, reliable, light weight, and low cost. The data is stored on a plastic recordlike, 8-inch soft magnetic disk, easily carried, stored, or mailed. It can be linked with various central data processing machines and with small and microcomputers for output, data gathering, computer terminal, or external storage, and is compatible with the IBM 3740 series of the USA. The technical parameters, the structure, and the theory of this magnetic disk recorder are described.

AUTHOR: HE Xinqian [0149 2450 5340]

ORG: Shanghai Electrical Meter Plant

TITLE: "JEZ-01 Cassette Type Digital Magnetic Tape Recorder"

SOURCE: Shanghai DIANZI JISHU [ELECTRONIC TECHNOLOGY] in Chinese No 1, 20 Jan 81 pp 43-44

ABSTRACT: At present, there are magnetic tapes in 2 widths, 3.81 mm and 6.30 mm. The JEZ-01 is the first domestic cassette digital magnetic tape recorder using the 3.81 mm width tape. It has been included among the products of Shanghai Electrical Meter Plant which are produced in small numbers. Aside from being compatible with the Chinese make microcomputers such as the 051, 052, and 061 and small computers such as the 100 series of JS-10 machine, it may also be used for collecting field data, digital communication, digital control, etc. Its work theory and properties are described.

AUTHOR: YE Miaokang [0673 5379 1660]

ORG: Shanghai Radio Electronic Meter Plant

TITLE: "800 Digital Frequency Counter"

SOURCE: Shanghai DIANZI JISHU [ELECTRONIC TECHNOLOGY] in Chinese No 1, 20 Jan 81 p 44

ABSTRACT: The 800 digital frequency counter is made to satisfy the needs of many users for frequency measurement. It is now under experimental production by the Shanghai Radio Electronic Meter Plant. Its frequency measurement range is 10 Hz to 700 MHz. Its sensitivity is better than 100 mV. It measures 220 mm in width, 78 mm in height, and 280 mm in depth, and weighs 4 kg. A block diagram depicting the work theory of the counter is included.

AUTHOR: WANG Mingan [3769 2494 1344]

ORG: None

TITLE: "LC Type TTL Multivibrator"

SOURCE: Shanghai DIANZI JISHU [ELECTRONIC TECHNOLOGY] in Chinese No 1, 20 Jan 81 p 47

ABSTRACT: When the TTL gate circuit is used to make a multivibrator it is usually the RC [Resistor Capacitor] type, with relatively poor frequency stability and easily influenced by power source voltage variations. If the integrated gate circuit is used to obtain the needed multiples of amplification and phase relationship, using the series circuit L and C for feedback and frequency selection network, then a simple LC type multivibrator may be constructed. The structure is simple; the frequency stability is good; it is not easily affected by external interference; it can put out regular square wave signals; and the oscillation frequency can be conveniently changed without changing the width ratio. The structure and the property of this multivibrator are explained.

6218
CSO: 4009

AUTHOR: CHEN Yuheng [7115 0060 1854]
WU Yupei [0702 7183 3099]

ORG: CHEN of Glass Design Academy of the Ministry of Construction Materials; WU of Beijing College of Steel and Iron

TITLE: "Introducing the Measurement and Mapping of Underground Caverns"

SOURCE: Beijing GONGCHENG KANCHA [ENGINEERING SURVEYING] in Chinese No 1, 22 Jan 81 pp 22-24

ABSTRACT: Underground caverns of various shapes and sizes are often formed by geological action or by subsurface mining. These caverns are very important for the national economy. Inestimable losses may be the result if engineering structures are built above such a cavern or caverns due to lack of knowledge of their existence; on the other hand, these caverns may also be used to store oil or gas, such as methane. The discovery of some Karst caverns also provides tourist sites. The authors have previously written papers (HUAGONG KUANGSHAN JISHU No 2, 75 and No 2, 78) on techniques of surveying and drawing underground caverns. This paper emphasizes, on the basis of the others, the newer techniques, including the optical method, the photographic method, the ultrasonic method, and the electromagnetic wave method. With respect to underground television, the authors claim that although it may now be used to observe and make video recordings of caverns, it still cannot be used to do measuring and drawing work.

AUTHOR: LIU Guangyao [0491 0342 1031]

ORG: Institute of Prospecting Technology, Ministry of Metallurgical Industry

TITLE: "Distinction Between the Main Channel and Its Boundary of the Gaoqiao Fluvioglacial Fan"

SOURCE: Beijing GONGCHENG KANCHA [ENGINEERING SURVEYING] in Chinese No 1, 22 Jan 81 pp 38-41

ABSTRACT: There are certain similarities between fluvioglacial fans and alluvial-pluvial fans, but there are also obvious distinctions. In view of the objective of finding water, attention obviously should be given to the sorting characteristic of the sediments. The vertical and the horizontal variations of the size of grains and the silt content are both significant for distinguishing the main channel and its boundary. The Gaoqiao fluvioglacial fan is located in the Yangang District of the southern part of Emei County [Sichuan Province], with the vertical axis measuring 15 km and a horizontal axis about 10 km. Following a description of the geological background of the Gaoqiao fan, the paper introduces the result of using aerial photos to distinguish the main channel and its boundary. The result is compared with results of hydrological and geological mapping, tapping experiments, and drilling.

AUTHOR: HAN Shoushan [7281 1108 1472]

ORG: Prospecting Design Academy No 3, Ministry of Railway

TITLE: "Research on the Determination of Seismic Liquefaction of Light and Subclay Soils of Tianjin City"

SOURCE: Beijing GONGCHENG KANCHA [ENGINEERING SURVEYING] in Chinese No 1, 22 Jan 81 pp 55-58

ABSTRACT: The Tangshan earthquake of 28 July 76 affected Tianjin in many ways. There are various ground surface deformations and a large amount of destruction of buildings due to loss of foundation stability. For the purpose of summarizing the experience regarding seismic resistance problems, the academy took on the special research subject of using static touch test and drilling test to determine seismic liquefaction of the light and subclay soils in the city of Tianjin. Factors causing liquefaction of light and subclay soils are much more complex than those of sandy soils. The interaction and relationship between the clay grains and powder grains are calculated. A comprehensive and multi-factor way of evaluation is found to be the best.

AUTHOR: WANG Guangjun [3769 1639 6511]

ORG: Institute of Seismic Resistance Engineering, Chinese Academy of Architecture

TITLE: "Observation and Analysis of Ground Surface Pulsation in the City of Beijing"

SOURCE: Beijing GONGCHENG KANCHA [ENGINEERING SURVEYING] in Chinese No 1, 22 Jan 81 pp 65-71

ABSTRACT: Ground surface pulsation means minute vibrations of less than several microns. It is generally believed to be a random response of the soil layer to the vibrating center. It is, therefore, a random process, and in a certain meaning, its periodicity reflects the dynamic characteristic of the soil layer. The result of observation of ground surface pulsation is often analyzed with a cyclic frequency spectrum. Based upon the analysis, the observed site is divided into three categories and the relationship between the pulsation characteristic and the earthquake damage is discussed. It is pointed out in the paper that ground surface pulsation may be used as a reference for determining the transmission function of the soil layer but it cannot, by itself, determine the ground surface movement characteristic of a strong earthquake.

6168
CSO: 4009

AUTHOR: None

ORG: Machine Tool Group Control Cooperative Group, Shanghai Machine Tool Plant No 4

TITLE: "Practice of Machine Tool Group Control System"

SOURCE: Shanghai JIXIE ZHIZAO [MACHINERY] in Chinese No 1, Jan 81 pp 9-12

ABSTRACT: Machine tools and the cutting property of the blades had developed to a relatively high level in the early 60's. If efforts were further exerted to raise the speed of tooling to bring about a higher productivity, the result would not have been obvious because the ratio of the effective tooling time in the entire processing procedure is already very small. Most of the time is spent in assembling the tools, adjusting the blades, loading and unloading the part to be worked, repeated starting and stopping of the machine, etc. According to statistics, the effective tooling time of an ordinary machine is only 15-20 percent. For this reason, attention must now be given to improving production management and automation if productivity is to be raised further. Due to its high cost, the development of group control systems had stagnated for awhile in the early 70's, but following the appearance of large-scale integrated circuits and great advancement in hardware and software of electronic computers, the state has again become interested. In foreign countries, 40 group control lines were established, in the USA there were 76, and 70 lines in Japan. Research on digital control of machine tools began at

[continuation of JIXIE ZHIZAO No 1, Jan 81 pp 9-12]

the plant in 1976, with the assistance of Shanghai Changjiang Machine Plant, Shanghai Institute of Machine Tool Research, and Shanghai University of Engineering. A cooperative group was organized to commence an experimental type research with the primary purpose of mastering the various application techniques of using computers in industrial control. Taking into consideration the problem of reliability of Chinese-made computer and its peripheral equipment, a decision is made to design a system capable of allowing individual machines to operate outside of the system at any time so that the experiment will not affect the actual production. This paper represents a brief report of the experiment to date. Various problems encountered in the process of experimentation are also briefly discussed.

AUTHOR: QIU Ji [5941 3078]

ORG: None

TITLE: "Saving Energy and Saving Materials in Heat Treatment"

SOURCE: Shanghai JIXIE ZHIZAO [MACHINERY] in Chinese No 1, Jan 81 pp 21-22

ABSTRACT: In the Second National Heat Treatment Experience Exchange Conference, it was proposed that the important task of those engaged in heat treatment work is to save energy, to save steel, and to increase the speed. In a machine manufacturing plant, the consumption of electricity in the heat treatment shop generally amounts to more than 40 percent of that of the entire plant. This paper discusses the problem of conserving energy and materials in the heat treatment process in four aspects: (1) reasonable design of structure of parts to make them suitable for the material as well as for a reasonable heat treatment requirement; (2) selection of optimal scheme of heat treatment; (3) selection of energy source, heat resistant materials, structure of heat treatment furnace and fuel system; (4) making heat treatment a specialized industry. In 1967, there were 462 plants in the USA specializing in heat treatment, undertaking 86 percent of the heat treatment work in that country. In 1970, Japan had 155 plants specializing in heat treatment and doing 78 percent of heat treatment work of that country. In China, heat treatment equipment is scattered in individual factories and there are several thousand places doing heat treatment in the country. This fact, more than anything else, is believed to be the cause of waste.

AUTHOR: None

ORG: None

TITLE: "Products of Shanghai Jiading Jiangqiao Agricultural Machinery Plant Introduced"

SOURCE: Shanghai JIXIE ZHIZAO [MACHINERY] in Chinese No 1, Jan 81 p 48

ABSTRACT: This paper is an advertisement introducing four products of the Jiangqiao Agricultural Machinery Plant, located in Jiading, Shanghai: (1) MW625 all purpose knife sharpening machine; (2) M4030A-1 chest type dust removing and polishing machine; (3) ST05-125-2 portable machine for vacuuming powdery dust; (4) M9017 portable dust vacuum cleaner. A photo of each of the four machines is included, as well as a brief description giving the properties and major parameters of the item.

AUTHOR: None

ORG: Shanghai Water Pump Plant

TITLE: "Shanghai Water Pump Plant's 3.1 m Axial Flow Pump"

SOURCE: Shanghai JIXIE ZHIZAO [MACHINERY] in Chinese No 1, Jan 81 p 6, front cover

ABSTRACT: The front cover of this issue of the journal is a photo of the large axial flow pump, 3.1 m in diameter. It is manufactured by Shanghai Water Pump Plant. Recently, the Ministry of Water Conservancy, and 31 related design academies, special schools of higher education, and research institutions have certified the pump as being a superior product in such factors as the noise level, the vibration, the flow volume, and the power consumption. Seven of these pumps were installed at the Jiangdu Water Conservancy Engineering Station No 4 of Jiangsu Province. They have been in operation for more than 10,000 hours safely, and a total of 68 hundred million m^3 of water has been pumped to irrigate the fields of the region of north Jiangsu. Shanghai Water Pump Plant has been making various types of pumps for many years and welcomes orders from customers.

6168
CSO: 4009

AUTHOR: DUAN Guosheng [3008 0948 0581]

ORG: None

TITLE: "Raise the Management of Craniocerebral Injuries to a Higher Standard in Our Armed Forces"

SOURCE: Beijing JIEFANGJUN YIXUE ZAZHI [LIBERATION ARMY MEDICAL JOURNAL] in Chinese Vol 6 No 1, Jan 81 pp 1-2

ABSTRACT: All China's armed forces hospitals have emphasized the treatment of craniocerebral injuries in recent years and a large number of clinical practices have helped to improve the technological level continuously. In many units, the mortality rate for severe craniocerebral injuries has been reduced from the previous 50 percent to about 30 percent. The paper proceeds to relate some progresses in that field in the USA and England and by comparison, China's front line units are still unable to clean the wounds thoroughly although they are now capable of performing superficial cleaning and administering decompression to save many lives from acute intracranial hematoma and edema. The bulk of the emergency rescue work falls on the second line and rear hospitals where new techniques, such as using magnetic needle to remove metal objects from the brain, have been developed. The paper suggests that, among other needed improvements, necessary tools should be provided to all levels of medical support units to enable them to perform emergency rescue and proper emphasis should be given to basic research on craniocerebral injuries.

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ZHANG Shanyuan [1728 3503 0337]

ORG: All of Liberation Army General Hospital

TITLE: "On the Criteria for Diagnosis, Surgery, and Result of Treatment in Severe Craniocerebral Injuries"

SOURCE: Beijing JIEFANGJUN YIXUE ZAZHI [LIBERATION ARMY MEDICAL JOURNAL] in Chinese Vol No 1, Jan 81 pp 3-6

ABSTRACT: Although diagnosis and treatment of craniocerebral injuries have progressed continuously in recent years, here and abroad, new techniques such as CT scanning, are still not commonly applied and opinions still vary with respect to many newly introduced methods. It is officially stated that those patients who are in a coma for more than 12 hours are considered as suffering from severe craniocerebral injury, but there is yet no precise definition for coma. From Jan 70 to May 80, the hospital treated 208 cases of severe craniocerebral injuries. These cases are analyzed and discussed with emphasis on the standard of diagnosis, and results of surgery and treatment. Of the group, 122 injuries are results of car accidents. The clinical data are given.

AUTHOR: GUO Feng [6751 1496]
WU Yuchan [6762 3768 5848]
LI Chuansheng [2621 1557 3932]

ORG: All of First Hospital of Second Military University of Medicine

TITLE: "Clinical Study of Cellular Immunity Tests in Primary Hepatic Carcinoma Patients"

SOURCE: Beijing JIEFANGJUN YIXUE ZAZHI [LIBERATION ARMY MEDICAL JOURNAL] in Chinese Vol 6 No 1, Jan 81 pp 7-9

ABSTRACT: Five cellular immunity tests, including OT, SK-SD, DNCB skin tests, E rose, and PHA lymphocyte transform tests, are carried out for 48 to 52 patients of hepatic carcinoma. At present, surgical removal is considered to be a feasible method for treating early stage hepatic cancer, but the disease easily recurs. Chemotherapy can kill cancer cells and will also reduce the patient's body immunity. Immune treatment can only partially improve the body's cellular immunity but cannot stop recurrence. Of the 35 cases receiving immunity treatment, there are 34 recurrence within 6 months to one year, indicating the necessity of combining it with chemotherapy. Combined use and analysis of cellular immunity tests are important in clarifying the immunity condition and deficiency of the patient, however. At present, extracorporeal cellular tests involved complex procedures. Their simplification and extension are awaited.

AUTHOR: CHEN Huisun [7115 1920 5549]
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CHEN Rongde [7115 2837 1795]
ZHANG Dachun [1728 1129 2504]

ORG: All of Institute of Field Surgery, Third Military University of Medicine and Laboratory No 6, Shanghai Institute of Organic Chemistry

TITLE: "Effects of Perfluotributylamine as Blood Substitute in Experimental Monkey"

SOURCE: Beijing JIEFANGJUN YIXUE ZAZHI [LIBERATION ARMY MEDICAL JOURNAL] in Chinese Vol 6 No 1, Jan 81 pp 21-24

ABSTRACT: This paper reports an experiment with 14 monkeys [Rhesus macaque] weighing 2.4-5.7 kg each. Perfluotributylamine is used to substitute blood for nine to form the experimental group, for the remaining control group of five hydroxyethyl starch is used. With the experimental group, the average quantity of perfluotributylamine used as blood substitute is 71.4 percent and the 48-hour survival rate is 55.6 percent. With the control group, the average hydroxyethyl starch used as blood substitute is 72.9 percent and the 48-hour survival rate is zero. The procedure of the experiment and the post-mortem observations are described and discussed.

6248
CSO: 4009

AUTHOR: FANG Hua [2455 5478]

ORG: None

TITLE: "Chemical Weapons Generate Concern Throughout the World"

SOURCE: Beijing XIANDAIHUA [MODERNIZATION] in Chinese Vol 3 No 3, 16 Mar 81 pp 10-11

ABSTRACT: In the past 2 years, during the invasion of Afghanistan by the USSR and that of Cambodia by Vietnam chemical weapons were frequently used. The reserve of chemical weapons of the USSR is the greatest in the world and they are already placed along the Sino-Soviet border. Under the definition of chemical weapons on the treaty signed in Feb 47, they include all chemicals capable of causing asphyxiation, death, or deformity to men, but various countries still have different interpretations. Stimulating agents [tear gas ?] are not considered as chemical weapons, however, and the police in China uses it also. The paper proceeds to explain various chemicals and the means of their deployment during wars. The toxicity of several nerve gases is described. Defensive measures against chemical weapons are also briefly mentioned, emphasizing the need of being prepared for them.

AUTHOR: LI Changli [2621 2490 4539]

ORG: Institute of Sonics, Chinese Academy of Sciences

TITLE: "Language-Code-Language"

SOURCE: Beijing XIANDAIHUA [MODERNIZATION] in Chinese Vol 3 No 3, 16 Mar 81 pp 34-35

ABSTRACT: In the past decade, astonishing developments have occurred in micro-electronics. The size of a microcomputer has been contracted to one 300,000th of the size of a computer 28 years ago, and consuming only 2.5 w of power instead of 140 kw while the computing capability has increased several tens fold. The appearance of microprocessors also provides a convenient way of processing language signals and that of large scale integrated circuits, the inexpensive devices to be used as sonic coders, which can maintain secrecy of communication between persons as well as between man and machine. As microcomputers become popularly extended, robots capable of conversing with their masters will become common tools of daily living. The paper includes a photo of a sonic coder made in China in 1977. The research on language encoders began in China in some unnamed research units and schools of higher education in 1958.

6168
CSO: 4009

AUTHOR: XIMEN Jiye [6007 7024 4764 2814]

ORG: Beijing University

TITLE: "On the Linear Transformations for Gaussian Trajectory Parameters in the Combined Electron Optical Systems"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENTS] in Chinese No 1, 1981 pp 1-11

TEXT OF ENGLISH ABSTRACT: In previous papers, a combined system consisting of a round lens and magnetic deflector with superimposed fields has been studied, and the general expressions for superimposed fields and trajectories are obtained. The Gaussian optical properties of the system are discussed. Formulae for the third order aberrations of the combined system are given. In this paper, according to the more general viewpoint, the effects of the magnetic deflector on the round magnetic or electrostatic lens may be considered as the linear transformations for Gaussian trajectory parameters. This paper introduces a generating aberration function to express all the third order aberrations of the combined system. Therefore, the expression for calculating aberrations is given in compact matrix form appropriate for numerical computation. These results may be used to design the cathode ray tubes and electron optical instruments, and for calculating more general cases with predeflection.

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TITLE: "An Experimental Scanning Electron Microscope DX-5"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENTS] in Chinese No 1, 1981 pp 12-17

TEXT OF ENGLISH ABSTRACT: A new model scanning electron microscope was developed recently based on the first Chinese DX-3 SEM, which has been on the market since 1975. The resolution of this new model DX-5 is 60 Å for the SE image. It is equipped with a variety of video signal processing devices. The high voltage source supplies a maximum acceleration voltage of 30 kV, and the Wehnelt bias is controlled photoelectrically. The specimen chamber is capable of accepting a dual fully-focused linear-type crystal spectrometer with optical microscope. The size of the electron optical column is much smaller than that of the old model DX-3. A vacuum linear tube with three apertures goes through the bores of the lenses. The specimen stage has five degrees of freedom, and the whole column is mounted on air buffers to minimize the vibration problem. In this paper the performances and characteristics of this SEM are given. Some aspects of the electron optical

[Continuation of YIQI YIBIAO XUEBAO No 1, 1981 pp 12-17]

system design, such as reduction of objective aberration, calculation of magnetic circuit using our coaxial-cylinder approximate model, Schlesinger deflection coil of semiconcentrated distribution and centering of the electron gun with a single deflecting set, are described. Finally, some difficult problems of tuning up this instrument to achieve high performances are briefly discussed.

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TITLE: "A Long-Life, High Brightness Cathode of Y_2O_3-Ir for the Electron Microscope"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENTS] in Chinese No 1, 1981 pp 18-23

TEXT OF ENGLISH ABSTRACT: In this paper a new long-life, high brightness cathode, Y_2O_3-Ir, suitable for the electron microscope is introduced. Its characteristics of thermal emission have been found to lie between the Th-W cathode and the LaB_6 cathode. The electron gun characteristics of this cathode have been measured as follows: the beam current stability may reach 7×10^{-3} in 30 s, the brightness may reach 2.8×10^5 A/cm^{2}sr and the cross over diameter is about 20 μ. Its physical and chemical properties are analyzed. The reason for long life is clarified. The The manufacturing techniques of this cathode and its situation of application to the transmission electron microscope and scanning electron microscope are presented. Some of the phenomena on the mechanism of emission of the Y_2O_3-Ir cathode and the preliminary analysis are given. Finally, the prospects of application of the cathode to the electron microscope and other electron optical instruments are discussed.

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TITLE: "A Component Proton Precession Magnetometer"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENTS] in Chinese No 1, 1981 pp 24-30

TEXT OF ENGLISH ABSTRACT: The proton precession magnetometer is a geomagnetic field measuring device based on the principle of NMR. The instrument has already been used widely in aeromagnetic surveying and marine magnetic prospecting. When the instrument is provided with two Helmholtz' coils it is able to measure the horizontal and vertical components of the geomagnetic field as well as its total intensity. The instrument has a maximum sensitivity of 0.1 gamma over a range of 20,000 to 65,000 gammas of the magnetic field. Total intensity measuring accuracy

[Continuation of YIQI YIBIAO XUEBAO No 1, 1981 pp 24-30]

is better than 0.3 gamma, and the horizontal or vertical component measuring accuracy is no less than 1 gamma. This paper outlines the basic principle of the instrument, describes the design requests and the distinguishing features of the critical assembly, and presents the results of station tests. We suggest the "error of closure" as a criterion for measuring accuracy and use the transient root-mean-square error to express repeatability and reliability of measurement of the instrument.

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TITLE: "The Measurement of Gradient Distribution of Pulsed Magnetic Field"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENTS] in Chinese No 1, 1981 pp 39-48

TEXT OF ENGLISH ABSTRACT: This paper introduces the measurement of gradient distribution of the pulsed magnetic field using the mini-dual-coil method. The coil is just like a "point," so it can represent the distribution of a small magnetic field more exactly. The noncoincidence of the two coils can be compensated for by adjusting the "symmetric circuit." In this paper, the principle of compensation is described. The signals coming from the coil are very weak. For measuring the gradient, the outputs of the two coils are connected in series-opposing, and the total signal is rather weak. Therefore, the instrument should be sensitive and the resolution of the instrument should also be high in detecting the slight variation of the gradient in the field. In addition, since a lot of data is collected in measuring gradient distribution, rapid and automatic measurement is necessary. According to these requirements, an instrument measuring the amplitude of the pulse signal is designed. Both the "direct measurement" method and the peak pulse-DC comparison method can be used to measure the amplitude of the pulse signal with

[Continuation of YIQI YIBIAO XUEBAO No 1, 1981 pp 39-48]

the instrument. The former method can rapidly and automatically print out the measuring data, and the latter can measure the peak value more precisely. Therefore it enables one to calibrate the former method using the latter one. By matching coils and the instrument, the reproducibility of measurement is better than ±0.1 percent. A measuring system has been set up while a vertical milling machine, which can be moved in three directions, X, Y and Z, is taken for the measuring bench. With this system the gradient distribution of the pulsed field in the gap of the prototype quadrupole magnet is determined. Measuring results show that the form of gradient distribution of the quadrupole is a "saddle," and the three-dimensional character of this type of quadrupole is also represented.

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TITLE: "An Improved Permeameter with Hall Devices"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENTS] in Chinese No 1, 1981 pp 49-57

TEXT OF ENGLISH ABSTRACT: At present, Köpsel permeameters and Sr'äblein permeameters are used in the workshop as rapid and direct-reading methods for the measurement of magnetic properties of permanent magnetic materials. These permeameters must be graduated by reference sample, their properties having previously been calibrated. The advantages of using the Hall device in magnetic measurement are: 1. A Hall device may be exceedingly small and capable of exploring fields in small spaces. 2. The output signals of the Hall devices may be superposed easily. Using the features of the Hall device, we improved the Köpsel permeameter which could be absolutely graduated. The measuring airgaps are arranged as near as possible to both ends of the specimen, and then almost all of the magnetic flux of the specimen passes through the measuring airgaps. The compensating Hall device is placed by the side of the specimen instead of the compensating coils. The compensating Hall device and the Hall device for measuring flux density are oppositely connected in series to eliminate the flux signal, which is produced by the magnetizing coils. The measuring error of the measuring equipment is ±5 percent when absolutely graduated, and ± 2 percent when calibrated by the reference sample.

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TITLE: "The Soft Magnetic Material Audio Frequency Character Tracer"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENTS] in Chinese No 1, 1981 pp 58-63

TEXT OF ENGLISH ABSTRACT: Usually the standard test for soft magnetic materials is the classical method, but it is inconvenient in engineering design and research of the material. In this paper the method tracing the soft magnetic material audio grequency character is described. The amplitude magnetization curve, amplitude permeability curve, hysteresis loop and iron loss curve are automatically traced from 40 c/s to 10 Kc/s. Their measurement accuracies are ± 3%~± 5% approximately. The theoretical base for designing the electric circuit has been given briefly. Some errors in the major units are specified. For example, the AC integrator, peak-to-peak detector and time division multiplier are specified. The block diagram of the circuit and the actual measured curves of some samples are given.

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TITLE: "Design and Performance of a High Resolution Double-Focusing Mass Spectrometer for Organic Analysis"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENTS] in Chinese No 1, 1981 pp 64-69

TEXT OF ENGLISH ABSTRACT: A high resolution mass spectrometer for organic analysis has been developed. This instrument is based on the ion optical system theory having complete second order double focusing as suggested by Matsuda. A mass resolution of 70,000 is achieved. At 8 kv accelerating voltage, the mass range of 1~1200 amu is obtained. Sensitivity of the mass spectrometer is better than $\times 10^{-11}$ c/μg (resolution 10,000). In the mass range of 18~999 amu, a marker of every mass peak on the UV recorder chart may be given, and the mass number's digit is displayed. Using the peak matching method, the accuracy of mass determination is 5 ppm within 10 percent mass range. The accuracy of mass determination of a high resolution mass spectra from the output of the data system is better than 5 ppm. An experiment demonstrates that a high mass resolution of the mass spectrometer can be achieved by a simple adjustment. It is known from experimental results

[Continuation of YIQI YIBIAO XUEBAO No 1, 1981 pp 64-69]

that the effect of slit width and slit width on the mass resolution is small. It confirms that the focusing characteristics of the optical system are available. The instrument has a conventional electron impact ion source, a field ionization/field desorption/electron impact combined ion source. We have built our emitter activation device. The sample inlet system of the instrument includes both the direct inlet and reference inlet for the standard sample PFK. The DJS-130 computer of the data system has 32K core memory, 16 bit, 2μs cycle time. The A/D converter of the interface has 16 bit 20 kc. The data system has the application programs of high and low resolution mass spectra. The analytical results of the sample of plant chemistry by means of the mass spectrometer are described. According to the table of element components of the data system output, molecular weight and molecular formula of the compounds may be determined.

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TITLE: "Ion Microprobe Analysis of Silicate Minerals: Characteristics of the Secondary Ion Mass Spectrum"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENTS] in Chinese No 1, 1981 pp 70-75

TEXT OF ENGLISH ABSTRACT: This paper reports the results concerning the characteristics of SIMS spectra of silicate mineral quartz, olivine, pyroxene and mica analyzed by using the domestically developed ion microprobe LT-1. Under the condition of ^{16}O-bombardment, the characteristics of the SIMS spectra obtained show: (1) the main atomic ions practically reflect the main elemental constituents; (2) the main atoms combine with oxygen to form a series of multi-atomic ions which can be regularly arranged as dim, trim, tetram, pentam, etc; (3) among the varieties and complexities of the intensity relationship of these multi-atomic ions, $(Si_2O)^+ > (Si_2O_2)^+ > (SiO_2)^+$ and $(Al_2O)^+ > (Al_2O_2)^+ > (AlO_2)^+$ are especially interesting abnormals worth further investigation; (4) no interrelationship exists between these multi-atomic ions and the original structural characteristics of the silicate

[Continuation of YIQI YIBIAO XUEBAO No 1, 1981 pp 70-75]

minerals. In the light of knowledge of the presence of these multi-atomic ions, the mass interference of the main elements on trace elements can be practically predicted.

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TITLE: "CAMAC Crate Controller for Interfacing DJS-131 Computers"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENTS] in Chinese No 1, 1981 pp 76-82

TEXT OF ENGLISH ABSTRACT: For the modernization of our scientific laboratories, various kinds of on-line computer systems are urgently required. We consider that the development of the CAMAC system will especially benefit the providing of different types of systems within a shorter period of time. The crate controller for interfacing model DJS-131 computer is designed for the purpose described above. DJS-131 is a general purpose minicomputer designed and produced in China, with word length of 16 bits and operation rate of 500 kilocycles persecond, which already equips many laboratories in China. This crate controller will facilitate potential applications of the CAMAC system. The crate controller is a triple width module which is connected to the computer I/O bus via the front panel edge connector. It conforms fully with mandatory requirements of the CAMAC specification EUR 4100e (1972). The crate controller is designed to provide programmed I/O transfer and data channel (DCH) I/O transfer. Program I/O transfer includes single I/O transfer and block transfer in the address scan mode. A 16-bit command register A is used to store NAF and two feature bits, MA and MN, which are used to

[Continuation of YIQI YIBIAO XUEBAO No 1, 1981 pp 76-82]

define the rules of address modification in the scan mode. The 24-bit data register consists of 16-bit register B and 8-bit register C. DCH transfer of the 131 computer is the direct memory access transfer, which is performed to access the data block at high speed. It is manipulated by DCH control logic circuit of the crate controller during DCH transfer. Register A with a DCH address is used to store the memory address, and is automatically incremented when one word is transferred. In order to match the computer with the DCH mode, a 16-bit word is used here, and the maximum block contains 4096 words. In order to obtain the highest block transfer rate, the special timing sequence has been arranged in the controller, which enables DCH transfer to continue without being interrupted. The CAMAC system for automatic measurement based on this crate controller has been established in the Shanghai Instrument Institute. It is used to test the reference Zener diode accurately and to find out the working area at zero temperature coefficient. The crater controller has also been successfully used in an energy spectrum multichannel analyzer in the CAMAC system.

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TITLE: "Multi-crate CAMAC System for Model DJS-130 Computer"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENTS] in Chinese No 1, 1981 pp 83-90

TEXT OF ENGLISH ABSTRACT: In modern laboratories, data acquisition and processing is very important. This is especially true in experimental high energy physics. Since the experimental equipment is enormous and complicated, it requires a high experimental data rate. Therefore, data acquisition and processing become even more obvious. In order to suit the needs of high energy physics and to enhance reliability and flexibility of experiments, we have established the DJS-130 multi-crate CAMAC computer on-line system. This system can be used in other fields also. The whole system consists of a DJS-130/CAMAC branch driver, crate controller type A and a variety of functional modules. In this system, the units are standardized except the branch driver, which is directly connected to the computer. The program designer may use the assembled language or another high level language. The DJS-130/CAMAC branch driver is an interface of the DJS-130 computer to the CAMAC crates. It is connected to the computer through the bus

[Continuation of YIQI YIBIAO XUEBAO No 1, 1981 pp 83-90]

driver and changes the control and status information to satisfy communication requirements. The LAM processing procedure is as follows: If a BD demand is sent by a crate to the branch highway and if it is not busy, it will execute BG operation automatically while executing BG operation. The data words of the BRW line will be latched onto the data register (used as the GL register), then the branch driver issues an interrupt request to the computer, which will acknowledge it if received. Crate controller type A is a standard equipment. It is essentially an interface of the CAMAC dataway to the branch highway. It is independent of the type of computer. The crate controller we developed conforms with the mandatory requirements of the CAMAC specifications on electrical performance. In a CAMAC system, the functional modules are the executive units. Different modules may have different functions. Several kinds of CAMAC modules have been developed in our laboratory: counter, coincidence register, real time clock generator, CRT display driver and dataway status, etc.

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TITLE: "The Method of Testing Stray Light in a Laser Raman Spectrometer"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENTS] in Chinese No 1, 1981 pp 91-99

TEXT OF ENGLISH ABSTRACT: In designing and constructing a laser Raman spectrometer, one of the important problems to be tackled is the rejection of stray light. It is necessary to study the origins of stray light in the spectrometer and the method and conditions of testing stray light. This paper presents the method of testing the stray light in a laser Raman spectrometer, and deals with the results of experimentation as well.

I. Stray light level: the stray light level at $\Delta\nu cm^{-1}$ in a Raman spectrometer can be characterized by $I_{\Delta\nu}/I_0$, where I_0 is the intensity of Rayliegh scattering light measured at the exit slit with the selected wavelength as an exciting line, and $I_{\Delta\nu}$ is the intensity of unwanted light at the exit slit when the spectrometer is set at $\Delta\nu cm^{-1}$ from the exciting wavelength. The distribution of stray light in a Raman spectrometer can be characterized by the so-called stray light "profile" --curve $I_{\Delta\nu}/I_0 - \Delta\nu$.

II. Testing method: The optical method is adopted. During the test the performance of a laser Raman spectrometer as well as the conformity of the testing

[Continuation of YIQI YIBIAO XUEBAO No 1, 1981 pp 91-99]

results with the actual operation of the instrument is taken into consideration, so that the real rejection of stray light in the spectrometer can be obtained. (1) A coherent source-laser is used: Ar^+ laser with wavelength of 5145 Å or 4880 Å, or Kr^+ laser with wavelength of 6470 Å. (2) Take a piece of chalk ($CaCO_3$) as the sample to measure the intensity of Rayliegh scattering light under the illumination of the laser and the intensity of unwanted stray light. (3) Use the detector and recorder of the spectrometer under testing. (4) Use a high density neutral filter combination consisting of several different density neutral filters. In this way an appropriate combination of density in the measurement process may be selected so as to attenuate the intensity of incident light, thus making the light signal emerging from the exit slit fit the detector.

III. The measurement procedure: In studying the stray light distribution within the range of $\pm$ 100 cm^{-1} from the Rayliegh scattering line of exciting wavelength, it is necessary to obtain the stray light "profile." The intensity of Rayliegh scattering light is measured first, then the wave number scan mechanism is set to change the value of $\Delta\nu$ step-by-step, and the corresponding value of $I_{\Delta\nu}$ is recorded. The $I_{\Delta\nu}/I_0 - \Delta\gamma$ curve is drawn last. For obtaining the correct results of the experiment, the following are taken into account: (1) Keep the output of the laser source stable in the whole course of measuring the stray light "profile." (2) The cooling temperature of the photomultiplier is kept constant so as to ensure the sensitivity of the photomultiplier being kept unchanged in the course of measurement. (3) The transmittance of the neutral filter combination is not equal to the product of that of the individual filters. One way to solve this is to adjust

[Continuation of YIQI YIBIAO XUEBAO No 1, 1981 pp 91-99]

while measuring and use the adjusted coefficient while calculating. (4) The zero point of the DC amplifier and zero line of the recorder are adjusted several times during the measurement. (5) No other source is allowed to enter the spectrometer under testing.
IV. Four factors affecting the stray light level measured are: width of entrance and exit slits, the intermediate slit width, height of the exit slit and wavelength of laser source.

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TITLE: "A New Method for Calculating Multi-diffractions of the Monochromator and Its Application in Design of Monochromators in the Laser Raman Spectrophotometer"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENTS] in Chinese No 1, 1981 pp 106-113

TEXT OF ENGLISH ABSTRACT: In accordance with the Cary principle, when the grating is rotated, if the locus of its edge is on the outside of all the normals of the mirror, there will be no multi-diffraction. This paper attempts to prove that it is not always necessary to strictly adhere to this principle. A new method for calculating multi-diffraction is put forward. As is usually the case, in the absence of multi-diffraction the lower limit of the off-axis angle of the mirror defined by the method is better than the value given by the Cary principle. The advantages of using this method are: (1) A higher degree of freedom in designing the instrument is obtained. (2) In a considerable number of cases, the quality of imaging may be improved. (3) The instrument can be made more compact. WEL Laser Raman Spectrophotometer is used as an example to show how the method is applied and to what extent it can improve the design. In addition, the paper points out that when the method is applied to various types of monochromators, useful results can be obtained.

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TITLE: "An Oxygen Sensor Assembled with Non-metallic Electrode"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENTS] in Chinese No 1, 1981 pp 114-119

TEXT OF ENGLISH ABSTRACT: So far, the working electrode of most membrane-covered oxygen sensors has been made of noble metals, such as gold or silver. It may be, however, easily corroded in the case of the presence of poisonous gases, such as hydrogen sulfide and sulfur dioxide, etc., which exist in polluted air or sewerage and thus make the oxygen sensor run unsteadily. We have prepared a new oxygen sensor with a working electrode made of non-metallic material. The working electrode is fabricated by mixing powders of 30 or 40 percent graphite and polyvinylidene fluoride. The electrochemical behavior of this working electrode is the same as that of those made of noble metals and it has very good anti-corrosive properties. Our newly designed oxygen sensor has been placed in the air for five months without interference of the sensitivity and reproducibility of oxygen detection.

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TITLE: "The Foreshock Sequence of the Haicheng Earthquake and Earthquake Swarm--The Use of Foreshock Sequences in Earthquake Prediction"

SOURCE: Beijing DIZHEN XUEBAO [ACTA SEISMOLOGICA SINICA] in Chinese No 1, 1981 pp 1-10

TEXT OF ENGLISH ABSTRACT: We have compared the Haicheng foreshock sequence with several earthquake swarms occurring in its neighborhood. Their spatial distribution was relatively concentrated. For the most part, the events occurred within a few kilometers of each other. The focal mechanisms are comparatively stable. However, there were several swarms in which the variations of focal mechanisms were quite obvious after the occurrence of the largest event of the sequence which would allow it to be recognized as a swarm. There were also swarms whose focal mechanisms were no less stable throughout the sequence than those of the Haicheng foreshock sequence. Therefore, this feature could not be used to identify foreshock sequences. The temporal distributions of foreshocks and swarms were quite

[Continuation of DIZHEN XUEBAO No 1, 1981 pp 1-10]

similar in some cases. This is again not a definite criterion for discriminating foreshocks and is only within our present ability, but is worthy of further study. Thus, in general, no definite criterion for identifying foreshock sequence has been found. Only for some earthquake swarms may it be recognized in its later stage.

Finally, we introduced a magnitude sequence with gaps which may be used if a large event is still forthcoming. This method (in conjunction with other methods) could be of use in areas prone to large earthquakes immediately before a large event to improve the determination of the probability of a large event occurring. We also note that the temporal distribution of all the sequences showed a 12-hour recurrence pattern that corresponded with the earth tides, showing that tidal forces might be influencing foreshocks and earthquake swarm occurrence.

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TITLE: "On the Anomalous Crustal Bulge and Aseismic Creep Prior to the 1976 Tangshan Earthquake"

SOURCE: Beijing DIZHEN XUEBAO [ACTA SEISMOLOGICA SINICA] in Chinese No 1, 1981 pp 11-22

TEXT OF ENGLISH ABSTRACT: Based on the observed data of 11 repeated surveys in the Tangshan area prior to the 1976 earthquake, an analysis has been made for the temporal and spatial variations of crustal deformation within this region. The results indicate that before the earthquake, from 1968 to 1969, a surface bulge of amplitude 50 mm, lasting for two years, took place in the epicentral region. Near Tangshan and Baodi, on the Tangshan fault and the Jiyunhe fault, superposition of accumulated strains and aseismic creeping are shown.

By adopting the theories of uniform strain accumulation and elastic dislocation, theoretical values of vertical displacements caused by creeping at the various parts on the faults respectively for the observation points near Tangshan and Baodi have been calculated, and by the principle of least residual root mean squares the optimal values of the parameters of strain accumulating and creeping fault were determined.

[Continuation of DIZHEN XUEBAO No 1, 1981 pp 11-22]

From 1969 to 1975, the creeping fault underneath Tangshan struck 47°NE, dipping 87° toward the SE, a right-lateral normal fault in character. Its length was 8 km, width 6 km, depth of burial 2 km, strike and dip slips amounting to 104 cm and 8 cm respectively, average rate of strain accumulation 0.9×10^{-7}/year. At the same time, the creep rate of the fault in the strike and dip directions were found to be 18.6 cm/year and 1.4 cm/year respectively. In addition, from the results on the Jiyunhe fault, the creeping rate near Baodi was smaller in dimensions than near Tangshan, but its creeping rate was greater than near Tangshan.

In this paper, also discussed is the connection between the relation of the above-mentioned anomalous crustal bulge and the occurrence of the Tangshan earthquake. Anomalous crustal deformation is considered as the early indication of the development of an earthquake, while aseismic creeping probably may be another precursory feature of a shallow earthquake. The occurrence of the Tangshan earthquake came through a long process of development of strain accumulation--volumetric dilatancy --inverse crustal deformation (or decrease of creeping rate).

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TITLE: "On the Hanjiang-Danjiangkou Reservoir Earthquakes"

SOURCE: Beijing DIZHEN XUEBAO [ACTA SEISMOLOGICA SINICA] in Chinese No 1, 1981 pp 23-31

TEXT OF ENGLISH ABSTRACT: The Hanjiang-Danjiangkou Reservoir is composed of two parts, the Dan River and Han River reservoirs. In the gorge district of the Dan River Reservoir, the limestone area consists of well-developed faults and joints, favorable to the permeation and circulation of water.

After impounding of water in November 1967, seismicity increased with the changes of the water level. The earthquake magnitude of the past few years rose from $M_S < 2.5$ to $M_S = 4.7$, and three earthquake clustered areas, elongating in the NNW direction, were formed near the gorge district of the Dan River Reservoir. Earthquake frequency and intensity correlate to a certain extent to the change of water level in the reservoirs.

Obvious crustal deformation was observed after the filling up of the reservoirs. Distribution of the stress field causing the deformation and the mechanism of earthquake inducing are discussed.

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TITLE: "Annual Variations in the Direction of Earth Resistivity and the Tectonic Stress Field in Continental China"

SOURCE: Beijing DIZHEN XUEBAO [ACTA SEISMOLOGICA SINICA] in Chinese No 1, 1981 pp 32-40

TEXT OF ENGLISH ABSTRACT: This work starts with some measurements of resistivity of rock specimens from mines and of certain concrete underground supports under stress for observing their variations of resistivity with direction. The results show that parallel to the stress the amplitudes of the annual variations become minimum, while perpendicular to it they become maximum. Halfway between, at an angle of about 45° to the stress direction, the amplitude values of annual variation of resistivity are medium.

Based on such a preliminary observation, we used the data of 98 earth resistivity stations scattered all over continental China, and divide the entire territory into three stress regions, namely: (1) the West China stress region, with nearly north-south stress direction; (2) the North China stress region, with northeast stress direction; (3) the Southeast China stress region, with east-west stress direction.

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It is thus possible to show the directions of the stress field in different parts of the country and at different times by observing in three directions at equal electrode spacings the annual variations of earth resistivity.

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TITLE: "Acoustic Emission of Rocks under Triaxial Compression along Various Stress Paths"

SOURCE: Beijing DIZHEN XUEBAO [ACTA SEISMOLOGICA SINICA] in Chinese No 1, 1981 pp 41-48

TEXT OF ENGLISH ABSTRACT: Acoustic emission of Jinan gabbro and Shangpin granite samples has been observed under triaxial compression along various stress paths (confining pressure up to 1.3 kb). When the maximum principal stress was increased until the rock sample failed (case A), the average acoustic emission rate gradually increased, an abrupt increase of acoustic emission occurring at about several hundred bars prior to rupture. When starting from a high stress state and the confining pressure was decreased (case B), an abrupt increase of acoustic emission occurred much later, only about 20-30 bars before rupture. The total number of acoustic emissions in the fracture process was much less, only one-third that in case A. There were two processes in case B: loading process for differentia. tensor component of the stress field and unloading process for spherical symmetric tensor component (hydrostatic). It is possible that the different characteristics of acoustic emission are due to the existence of the unloading process.

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TITLE: "Observation of Microcracks within Gabbro in Experiments along Various Stress Paths"

SOURCE: Beijing DIZHEN XUEBAO [ACTA SEISMOLOGICA SINICA] in Chinese No 1, 1981 pp 49-54

TEXT OF ENGLISH ABSTRACT: The microcracks within crystal grains of Jinan gabbro have been observed in experiments along various stress paths. We load the rock sample to a certain high stress state, the differential stress reaching about 80 percent of the ultimate strength of the gabbro specimen. Then further stress is applied along various stress paths A, B and C. These paths were described in a previous paper (Geng et al., 1979). After unloading, the rock samples are cut and polished or thin sections are made. It is observed that there exist obvious differences in microfractures among the three cases. In case B, most of the microcracks in plagioclase are shortened, their lengths being less than the minor axis of the plagioclase grains. These cracks are concentrated in rather narrow regions. In case C, the number of inclined microcracks increases, and the microcracks in the plagioclase grains become much longer and much more in number than those in cases A and B. There appear some "star-like" microcracks. It is possible that the microscopic feature in gabbro is related to the "super-dense" and "ultra-dilatant" state of the rock samples.

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TITLE: "Preliminary Study of the Application of Hydrogeochemistry to Earthquake Prediction"

SOURCE: Beijing DIZHEN XUEBAO [ACTA SEISMOLOGICA SINICA] in Chinese No 1, 1981 pp 55-60

TEXT OF ENGLISH ABSTRACT: For about a decade, variations in hydrogeochemical constituents have been used for earthquake prediction in China. The experiences in foretelling several earthquakes have indicated that hydrogeochemistry may be a possible means for mid- and short-term earthquake predictions. In this paper, by outlining the characteristics of hydrogeochemical anomalies observed before several strong earthquakes with $M \geqslant 7$ occurring in recent years in China, particularly three which occurred in north China, an attempt is made to discuss the role of hydrogeochemistry in earthquake prediction and the main factors that influence precursory variations in hydrogeochemistry. Furthermore, a preliminary study on the mechanism of the precursory hydrogeochemical anomalies is made.

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TITLE: "Distribution Laws of Recurrence Periods and Magnitude Sequence of Great Earthquakes in Mainland China and Its Surrounding Regions"

SOURCE: Beijing DIZHEN XUEBAO [ACTA SEISMOLOGICA SINICA] in Chinese No 1, 1981 pp 61-68

TEXT OF ENGLISH ABSTRACT: In mainland China and surrounding regions, the recurrence periods of great earthquakes obey nearly the normal distribution law with mathematical expectation $m = 39.5$ months and $\sigma = 3.3$ months (variance σ^2) within a seismic active time interval while the recurrence magnitude sequence may be described by a nonhomogeneous Markov chain.

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TITLE: "Continuous Prediction of Large Earthquakes"

SOURCE: Beijing DIZHEN XUEBAO [ACTA SEISMOLOGICA SINICA] in Chinese No 1, 1981 pp 69-80

TEXT OF ENGLISH ABSTRACT: The purpose of this work is to establish at any time t formulas for the time and region of the next large earthquake to occur within continental China.

At first a criterion may be obtained to estimate the possibility of the occurrence of a large earthquake in this region during the three months following time t. If it should occur, then a prediction is made of its time and location.

These formulas are derived by using the relation between the time and regional data of the earthquakes occurring in both the world and continental China, and by applying the Theory of Stochastic Processes.

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TITLE: "On the 768-Type Radio Seismic Telemetry Equipment"

SOURCE: Beijing DIZHEN XUEBAO [ACTA SEISMOLOGICA SINICA] in Chinese No 1, 1981 pp 81-89

TEXT OF ENGLISH ABSTRACT: The type 768 radio seismic telemetry equipment has been designed for use in the case when installation between points of a seismic station network is difficult or in those places where the line capacity is not sufficient. Of course, it can also meet the need in the areas immediately after the occurrences of destructive earthquakes.

It consists of a pair of ultra shortwave transmitter and receiver. A double frequency modulation was adopted. Not only can it be directly connected to a single component short period seismometer to transmit seismic analogue signals within the frequency range of 0.5 Hz to 25 Hz, but it can also be used in combination with the specially designed multiple-channel digital telemetry system to transmit 0.2 Hz to 20 Hz $CHDB_4$ code (compatible high density binary code). Therefore this equipment is capable of transmitting signals such as geoelectric, geomagnetic, ground stress, ground tilt and many other geophysical quantities.

Since July 1977, this equipment has been put to actual transmission tests at the

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seismic station networks of Beijing, Shanghai and Tianjin. After that, it was installed at the seismic station network of Kunming for more than one year. The results show that this equipment is superior in its portability, sensitivity, stability and immunity from disturbances. For a sufficient antenna height, the distance of transmission can reach about 115 km.

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TITLE: "Pulse Response and Initial Motion of a Seismometer Coupled with a Galvanometer"

SOURCE: Beijing DIZHEN XUEBAO [ACTA SEISMOLOGICA SINICA] in Chinese No 1, 1981 pp 90-101

TEXT OF ENGLISH ABSTRACT: The pulse response of a seismometer coupled with a galvanometer is studied theoretically and, using the results of numerical computation, the fundamental characteristics of the pulse response of the Kirnos type seismograph are analyzed. For this seismograph, an analytical expression of the pulse response for certain forms of the displacement function has been derived. Characteristics of the initial motion of the Kirnos type seismograph are obtained by using the results of numerical computation. They show that a large difference between the characteristics of the initial motion and the steady state actually exists.

AUTHOR: None

ORG: None

TITLE: "A Seismological Symposium under the Joint Sponsorship of the Chinese Seismological Society and the State Seismological Bureau"

SOURCE: Beijing DIZHEN XUEBAO [ACTA SEISMOLOGICA SINICA] in Chinese No 1, 1981 pp 102, 104

TEXT OF ENGLISH ABSTRACT: From 28 November to 4 December 1980, a seismological symposium was convened in Shanghai, sponsored by both the Chinese Seismological Society and the State Bureau of Seismology. About 150 seismologists from all parts of the country came to attend the convention.

Altogether 203 scientific papers were received and, among them, 113 were read at the various sections of the symposium. Gu Gongxu, president of the Chinese Seismological Society, and Wei Yiqing, vice-director of the State Seismological Bureau, gave talks on a plenary session.

Two committees were organized, namely the Committee of Seismological Research and the Committee of Seismological Observation.

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